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# HIGHLIGHTS NATIONAL CONFERENCE ON AIR POLLUTION, 1958

Public Health Service
Washington, D. C.

1959

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*Highlights*

# NATIONAL CONFERENCE ON AIR POLLUTION 1958

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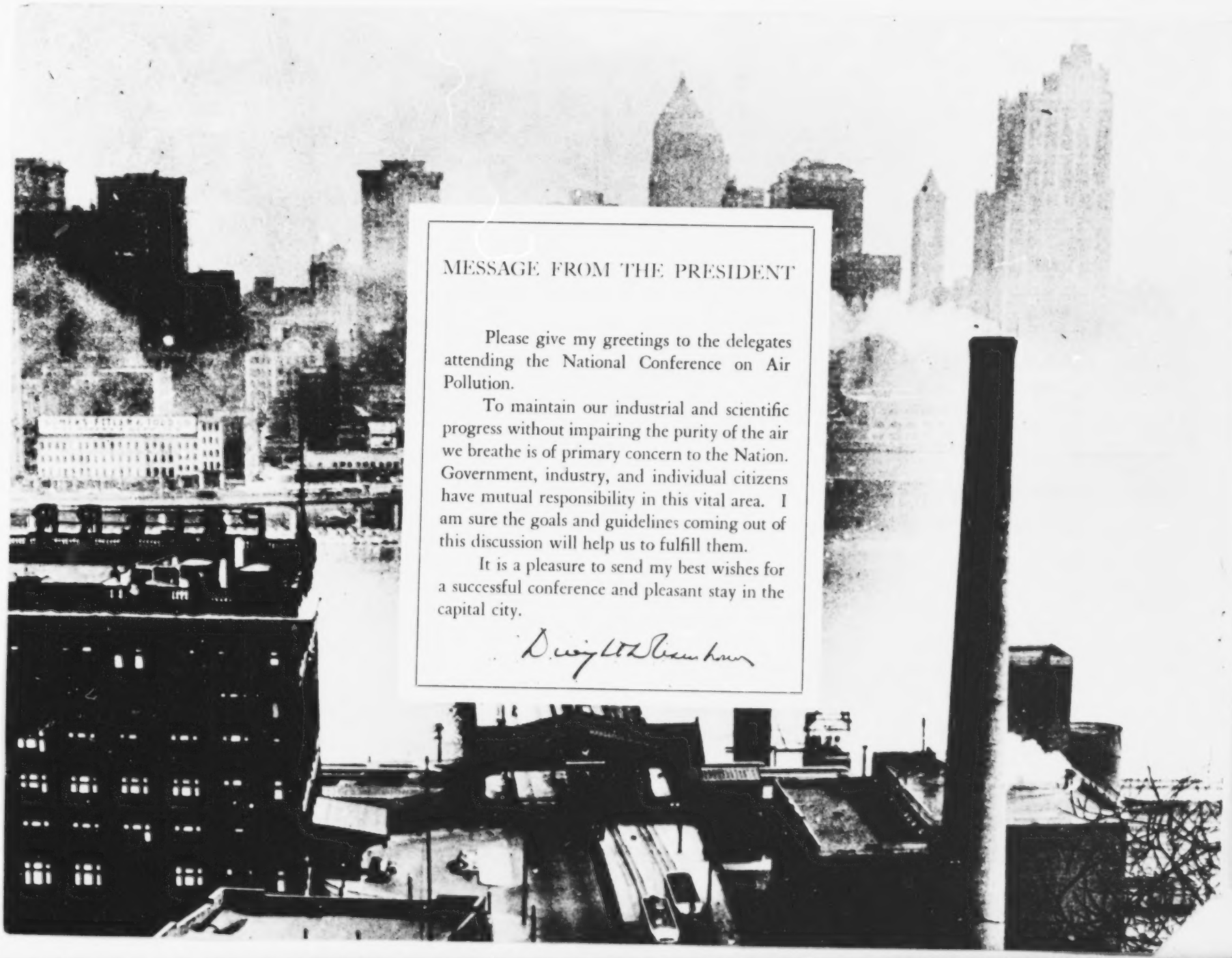
U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service



## MESSAGE FROM THE PRESIDENT

Please give my greetings to the delegates attending the National Conference on Air Pollution.

To maintain our industrial and scientific progress without impairing the purity of the air we breathe is of primary concern to the Nation. Government, industry, and individual citizens have mutual responsibility in this vital area. I am sure the goals and guidelines coming out of this discussion will help us to fulfill them.

It is a pleasure to send my best wishes for a successful conference and pleasant stay in the capital city.

Dwight D. Eisenhower

# *Highlights*

# NATIONAL CONFERENCE ON AIR POLLUTION

## 1958

Details of illustrations in this document may be better studied on microfiche.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

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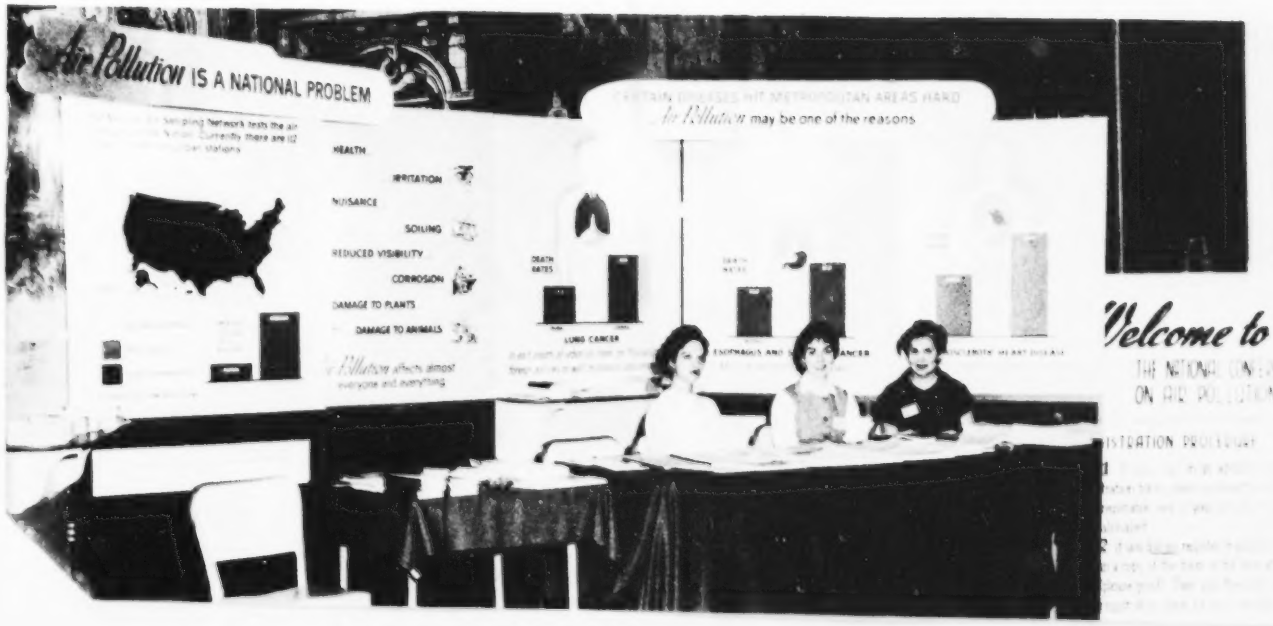


# INTRODUCTION

## The Idea of the Conference

The quality of the air affects everyone. Recently, particularly since World War II, as more and more people have concentrated their activities in urban areas and as our industry has expanded at an almost unbelievable rate, the harmful potential of polluted air has multiplied many-fold. Pollution in the air has grown greater in quantity and infinitely more diverse in kind. The number of people within range of its effects has increased spectacularly.

Many significant conferences on air pollution and its control have been held in the past. These were primarily of a technical nature, in which professionals in the field exchanged ideas and newly-gained knowledge.

But, prior to 1958, the problem had not been subjected to the study of persons whose interests were related less immediately but no less certainly to the quality of air. It seemed desirable that they—representatives of professional and voluntary groups concerned with public health, with government and administration in communities and States, with citizen action in its many forms, with formulation of industrial policy—be brought together to consider this growing problem of man's relation to his self-created environment.

As the concept of the National Conference on Air Pollution took shape, therefore, the key word was "inter-disciplinary." When Surgeon General Leroy E. Burney of the Public Health Service called the Conference, he made it clear that everyone concerned with air quality—i. e. everyone—was invited.

The Conference goals were, first, a realistic assessment of the present status of knowledge and level of activity in the air pollution field, and, second, a determination of practicable future objectives based on this assessment, delineating specific responsibilities for all concerned. An awakened interest in and knowledge of air pollution on the part of the public and its leaders, many of whom would be participating in the Conference and would have important roles to play in future control activities, was considered an important and desirable by-product.

## The Conference Plan

To build a plan for such a Conference, the Surgeon General and his staff called together a Conference Steering Committee charged with specific advisory responsibilities. This group, whose membership representing the key professional associations and other groups interested in the field is listed elsewhere in the report, met first in April and again in August. The Conference structure and procedure emerged from these deliberations.

It was clear that two types of presentation would be required to meet the objectives: an exposition of current knowledge in the field, for all participants; and an opportunity for each participant to contribute his own views to the formulation of future goals. The first could be ac-

complished most efficiently through plenary sessions, and the second through group discussions based on individual interests.

The members of the Steering Committee recognized that their own intimate knowledge of the air pollution problem was, in a sense, a handicap in planning a Conference for persons less well acquainted with the field. It was decided, therefore, to form an Inquiries Committee which would include leaders of precisely the sort of organizations which the Conference hoped to attract. This group, whose membership is also noted in this report, posed a series of questions to the Conference, the answers to which would be of special interest and importance to the public.

Through the summer and fall, the Conference format thus established was developed and refined. Speakers best qualified to digest and interpret the facts on air pollution for a non-technical audience were invited to address the plenary sessions. Outstanding specialists were selected to serve as chairmen and vice-chairmen of the six discussion groups into which the Conference was to divide. These discussion group leaders, with assistance from Public Health Service resource persons, developed the programs for their own groups. Meanwhile, through personal contacts, correspondence, and the use of various communications media, a major effort was made to inform the public and representative groups about the problem, so as to encourage maximum participation in the Conference.

## The Conference in Action

Between Tuesday morning, November 18, and Thursday evening, November 20, 1958, about 1,000 persons took part in the National Conference on Air Pollution at the Sheraton-Park Hotel in Washington, D. C. Of these, the largest single group, comprising almost one-third of the participants, represented a wide variety of industries. Universities and research organizations accounted for about 150 delegates.

City and county governments, including health departments, pollution abatement units, engineers, and several mayors, had 150 representatives at the Conference. State governments had about 75 delegates, chiefly from health departments but including also a number of other departments, an assistant attorney general, and legislators.

Virtually all the major voluntary organizations in fields related to health and welfare were represented, as were a large number of professional and scientific associations. Men's and women's civic organizations, chambers

Dr. Edwin D. Harrison

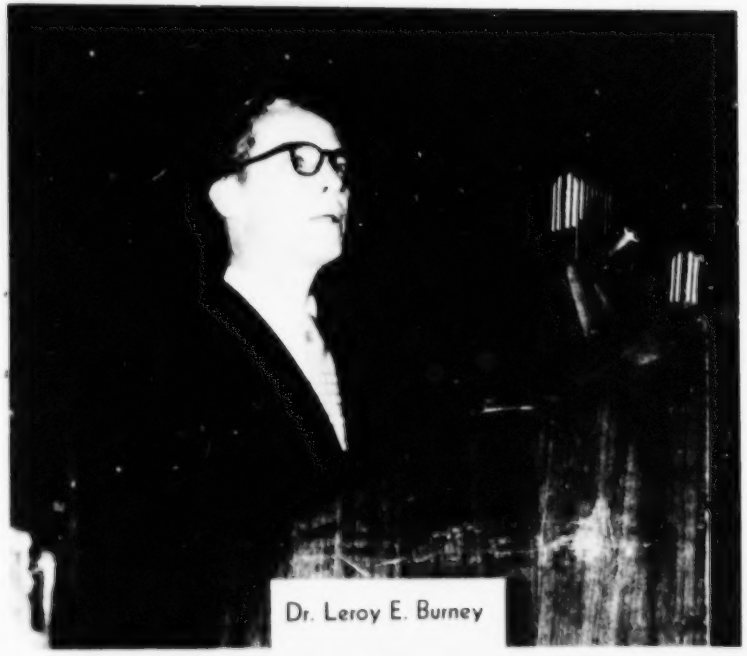
of commerce, conservation groups, farmers' organizations, labor unions, and industrial and trade associations also sent representatives to the Conference. A list of the national organizations represented appears elsewhere in this report.

A total of 41 States were listed on the attendance roster, plus the major territories and such foreign nations as Canada, the Philippines, and the United Kingdom.

According to the plan developed by the Steering Committee and the Public Health Service staff, the participants received background information through a series of talks and symposia in plenary sessions on the first day of the Conference. The second day was given over entirely to discussion group sessions, in which the conferees discussed the questions framed by the Inquiries Committee and drafted recommendations. On the third day, these recommendations were presented to a plenary session, which was also addressed by Secretary Arthur S. Flemming of the Department of Health, Education, and Welfare. The Conference was concluded with an open forum session in which everyone was invited to express opinions and ask questions. Martin Agronsky, well known news commentator of the National Broadcasting Company, closed the Conference with a brief summarization of highlights from the point of view of the public.

A banquet was held on the evening of November 18, with Dr. Abel Wolman of Johns Hopkins University serving as toastmaster. Dr. Edwin D. Harrison, President of Georgia Institute of Technology, delivered the principal address on the subject of "The Other Side of Science." Dr. Harrison's talk was followed by a "Response" from Mr. Arnold Arch, President of the Air Pollution Control Association.

The public interest potential of air pollution and its control was demonstrated by the extensive news coverage of the Conference by the press, television and radio. Newspapers in virtually all the major cities ran daily stories on the subject, and the Conference was highlighted in the principal weekly news magazine. News commentators, both network and local, reported the Conference on television, and air pollution was the subject of several special programs.



Dr. Leroy E. Burney

# PLENARY SESSIONS

The opening session on Tuesday morning, November 18, provided a framework of concepts and ideas relating the air pollution problem to our society as a whole. Against this backdrop were projected the more specific presentations of the afternoon sessions and the still more detailed discussion papers the following day.

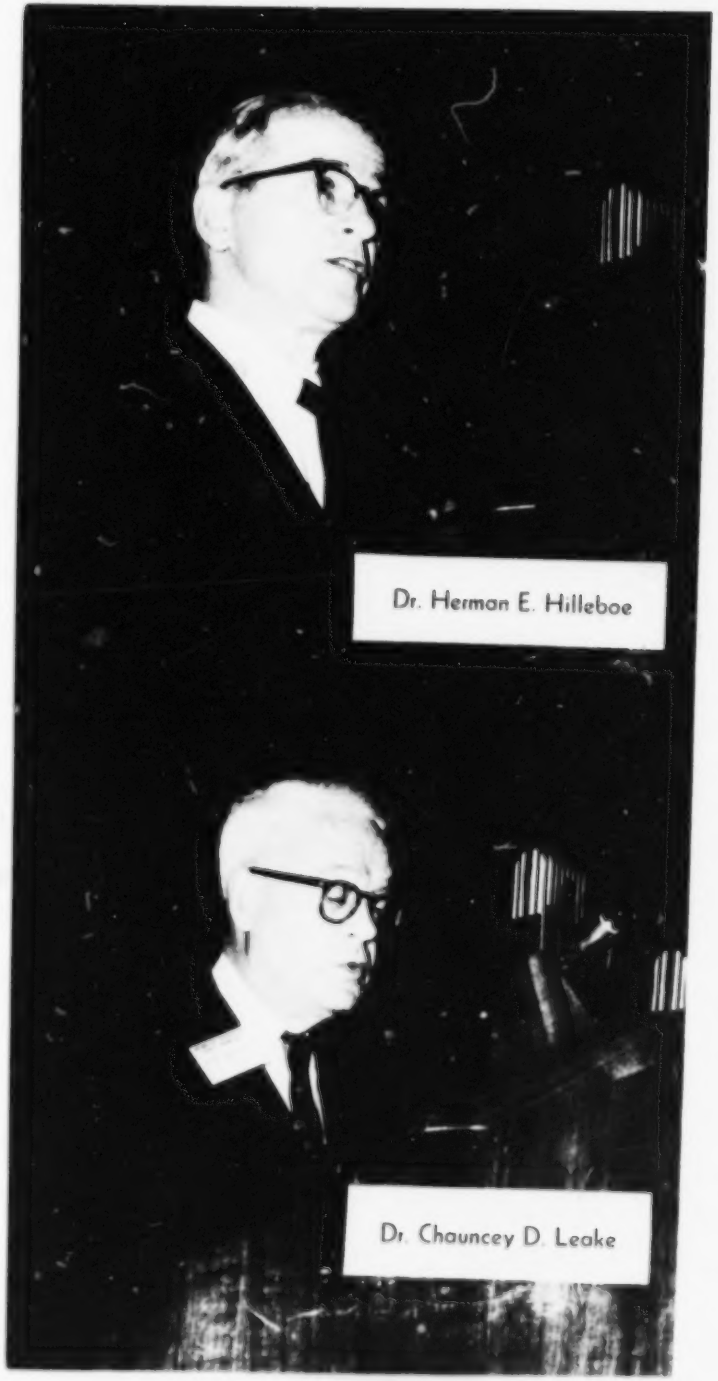
Surgeon General Leroy E. Burney outlined the Public Health Service program being conducted under Public Law 159 of the 84th Congress. He pointed out that about 80 percent of the $12.5 million thus far appropriated for the program has been used to support research. Among the research projects in progress, Dr. Burney cited statistical studies which show that lung cancer death rates are twice as high for the largest cities as those for rural areas; a follow-up study of Donora, Pennsylvania, where 20 people died from acute air pollution ten years ago, in which it was found that those persons who were made ill by the 1948 smog have had poorer health and higher mortality rates than their neighbors who were unaffected by the episode; and various laboratory experiments demonstrating harmful effects of specific pollutants.

Dr. Burney described the operation of the National Air Sampling Network, with headquarters in the Public Health Service's Sanitary Engineering Center, which collects and analyzes samples of air from 180 cities and 51 non-urban sites.

In regard to the health effects of polluted air, Dr. Burney drew a parallel between our present position and that of Pasteur's predecessors confronted by communicable disease:

"Many years ago, before anyone had . . . positively identified a single causative agent of epidemic diseases, far-sighted leaders observed the association between epidemics and filth. Wherever they had sufficient foresight to act on this circumstantial evidence, they made striking progress. Cleaning up the city filth resulted in better health. Years later they found out why."

In closing, Dr. Burney challenged the conferees to be "as flexible" as air pollution itself which "respects no boundary lines—geographic, political, professional or disciplinary."




Dr. Herman E. Hilleboe, Commissioner of the New York State Department of Health, described the problems confronting a State or local official who wishes to establish an air pollution control program. Observing that "Americans are a nation of Missourians when they are asked to spend money," he called for the presentation to the public of ". . . cold, hard, irrefutable facts, facts that say loudly and clearly 'Air pollution is unhealthy; unpleasant to live with, and in the long haul a lot more expensive to put up with than to control.'" Dr. Hilleboe stressed the need for demonstration programs to prove the benefits of pollution control, and emphasized the difficulty of obtaining trained personnel to conduct such programs. He urged that the Public Health Service carry out "a crash recruitment and training program in air pollution control," to provide the necessary impetus for State and community efforts. "If this is not done, and soon, irreparable damage will result," Dr. Hilleboe said.

Senator Thomas H. Kuchel of California, in a paper read by his Staff Assistant Warren B. Francis, described briefly the history of Public Law 159, which he had sponsored in Congress, and stated that "I am prepared to introduce next year new legislation which will implement, extend, and carry forward Public Law 149 under which present work is carried on."

Senator Kuchel said that "the human stake in this fight is great, because of the tremendous price our Nation may pay for continued contamination of the air all of us breathe, every moment of our lives." He emphasized the need for active cooperation by industries and private organizations as well as public agencies at all governmental levels.

"I sincerely trust this conference will be dedicated to the principle of pooling resources in the traditional American fashion so that the public welfare may be benefited to the greatest degree of which we are capable."

Dr. Chauncey D. Leake of Ohio State University, representing the American Association for the Advancement of Science, declared that "Individual and group responsibility for the purity of our common air makes this matter a social problem, of interest to society generally . . . ." "We all want pure air to breathe. We need it. It is the business of scientists to tell us how this can be obtained. It is the business of all of us to apply the scientific knowledge we can get on air pollution to the simple proposition of conserving pure air," Dr. Leake said. He also called attention to the air pollution resulting from nuclear weapons as "potentially very dangerous . . . involving all living things, now and to come."

Dr. Louis C. McCabe, President of Resources Research, Inc., described the problems confronting the 1950 National Technical Conference on Air Pollution of which he had been chairman. Among the data presented at that conference, Dr. McCabe mentioned studies of striking reductions in certain pollutants which had been achieved by Pittsburgh and St. Louis. He noted that by 1950 the change in emphasis from "smoke prevention" to "air pollution control" was well underway. As an illustration of the status of knowledge at the time of the 1950 Conference, he quoted the Health Panel: "The complexity of the problem is such that further evidence must be sought before the hazard to public health can be appraised adequately."

Dr. David E. Price, Assistant Surgeon General of the Public Health Service, charged the conferees with the task of analyzing the respective responsibilities of Federal, State and local governments, industries, and the individual citizen. "Finally," Dr. Price said, "We ask you to evolve a program for the future to which we all can subscribe, a charting of the course before us." Such a chart should "assign specific tasks to the groups best qualified to handle them" and "suggest relative priorities and include some sort of time-table."

## Symposium on Status of Knowledge

During the Tuesday afternoon plenary session, the participants acquired further basic facts bearing on present knowledge of pollution in the atmosphere and heard reports on control efforts in progress.

Dr. Herbert C. McKee of the Southwest Research Institute in San Antonio opened the first symposium by establishing a distinction between "localized" air pollution problems, on the one hand, and community-wide problems on the other. The localized problem affects a relatively small area, usually located downwind from one or more specific sources of pollution. It may be characterized by odors, dusts, smokes or vapors from any one of a great variety of human activities. In contrast, the community-wide problem affects a wide area simultaneously; "the atmosphere gets in such a mess that frequently it is impossible to distinguish one pollutant from another, or to tell where each comes from." Typical of such community-wide problems are the "coal-smoke" complex found in many eastern cities and the "smog" encountered in Los Angeles and other western communities.

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## PROGRAM • PLENARY SESSION

**Tuesday, November 18**

9:30–12:00 Plenary Session—Sheraton Hall

Chairman—Dr. Leroy E. Burney
Surgeon General, Public
Health Service

Status Report to the Nation—Surgeon General Burney
State and Community Needs and Responsibilities—Dr. Herman E. Hilleboe, Albany, representing Association of State and Territorial Health Officers
The Public's Interest—Thomas H. Kuchel, U. S. Senator, California
Social Aspects of Air Pollution—Dr. Chauncey D. Leake, Columbus, Ohio, representing American Association for the Advancement of Science
Technical Aspects, the 1950 Assessment—Dr. Louis C. McCabe, President, Resources Research, Inc., Washington, D. C.
Conference Objectives—Dr. David E. Price, Assistant Surgeon General, Public Health Service

Dr. Louis C. McCabe

## PROGRAM • PLENARY SESSION

Tuesday, November 18

1:30—4:30 Plenary Session—Sheraton Hall

Chairman—Surgeon General Burney

### SYMPOSIUM—STATUS OF KNOWLEDGE

What's in the Air?—Dr. Herbert C. McKee, Manager, Air Pollution Research, Southwest Research Institute, San Antonio

Where Does it Come From?—Dr. Leslie A. Chambers, Research Director, Los Angeles County Air Pollution Control District

What Does it Do to Humans?—Dr. James P. Dixon, Commissioner, Department of Public Health, Philadelphia

What Are the Costs to Society?—Dr. Reuben G. Gustavson, President, Resources for the Future, Inc., Washington, D. C.

What Can be Done?—Charles W. Gruber, Engineer, Bureau of Air Pollution Control, Cincinnati

### SYMPOSIUM—ACCOMPLISHMENTS

By Control Agencies

Raymond R. Tucker, Mayor of St. Louis

By Industries

Steel: Max D. Howell, Executive Vice President, American Iron and Steel Institute, New York City

Automobile: Harry A. Williams, Managing Director, Automobile Manufacturers Association, Detroit

Chemical: General John E. Hull, President, Manufacturing Chemists' Association, Inc., Washington, D. C.

Petroleum: Dr. Jerry McAfee, Vice President, Gulf Oil Corporation, Pittsburgh; Chairman, Smoke and Fumes Technical Advisory Committee, American Petroleum Institute

Dr. Leslie A. Chambers of the Los Angeles County Air Pollution Control District stated that "the points of origin of the primary pollutants going into the atmosphere are identifiable and their relative contributions readily assessable." Primary pollutants—substances arising from industrial, commercial, domestic or other activity—are not the only problem to be considered, however. They must be distinguished from "secondary" pollutants which result from chemical interaction of primary pollutants in the air and which are more difficult to analyze. After outlining in detail the results of studies of Los Angeles air, Dr. Chambers concluded: "After the sources have been located, the real problems arise. What can be done to control them? For Los Angeles this question has become, very pointedly, how can we control pollutants produced from 3 million automobiles?"

Dr. James P. Dixon, Commissioner of Health of Philadelphia, described the known and suspected effects of air pollution on human health. After discussing the death-dealing smogs of London, Donora, and elsewhere, he summarized evidence of chronic effects which "supports a strong suspicion that air pollution may play a role . . . in the development of (diseases incident to urban living), including lung cancer." He urged two courses of action: making "every reasonable effort" to reduce pollution, and vigorously encouraging research into specific health effects. "If gas masks are not to become as common in a hundred years as shoes are today," Dr. Dixon said, "We should do well to heed our somewhat submerged instincts of self-preservation and remember that—whatever other uses Man may devise for it—air is still essentially for breathing."

Dr. Reuben G. Gustavson, President of Resources for the Future, Inc., stated that man is "an animal who pollutes his nest as few animals do." Our pollution of the air, water and soil makes it necessary that "government and private industry cooperate in spending large sums of money" for "basic answers to some of the very fundamental sources of pollution," Dr. Gustavson said. He cited estimates that air pollution costs the nation at least $7.5 billion per year, while observing that cost figures are difficult to obtain and recommending more work in the field of air pollution economics.

Charles W. Gruber of Cincinnati's Bureau of Air Pollution Control urged communities to establish air pollution control programs, with both regulatory and monitoring services. He noted that, as in the case of his own city, "regulatory programs are not patently citizens against industry . . . In many communities the clamor for action has resulted in regulation over the citizen himself." Mr. Gruber called for establishment of air quality criteria, and urged "contributors" to air pollution to solve their own problems through selection of advantageous sites, processes and fuels and through application of existing control measures.

Mayor Raymond R. Tucker of St. Louis summarized the achievements of air pollution control agencies since their development early in the twentieth century. "It can be truthfully said that the battle against the city smoke palls has been won," Mayor Tucker said. "The control agencies can congratulate themselves on this—it is a battle they fought, almost alone, for many years * * * If there be a locality still suffering from old fashioned smoke palls, it is because it has disregarded the well proven tools." He then outlined progress in controlling pollution from trash disposal, and from industrial sources that is taking place as a result of the shift of emphasis from smoke to other atmospheric pollutants within the past decade. Stressing the importance of control agencies, Mayor Tucker stated that "No Program, no matter how brilliantly conceived, can be better than its enforcement."

Max D. Howell, Executive Vice President of the American Iron and Steel Institute, told the conferees that two member companies had spent more than $84 million on air cleaning equipment since 1950. He described a number of pollution challenges which had been met by the industry and pointed to the development of instrumentation as well as control equipment. Terming the effluent from open hearth furnaces "the industry's largest and most persistent problem," Mr. Howell observed that "precipitation of open hearth dust is still more of an art than a science." Nevertheless, one company has equipped 9 open hearth furnaces, with precipitators at a cost of $5.5 million. Mr. Howell stated the industry's determination to solve pollution problems "as speedily as may be possible."

Harry A. Williams, Managing Director of the Automobile Manufacturers Association, pointed out that his industry had the unique problem of concerning itself with "how the consumer uses or misuses the product long after its sale to the public." He cited progress made by the industry in the past, first in eliminating smoke from vehicle exhaust and later in reducing carbon monoxide. He referred to the present exhaust pollution as "a new type of monster" arising from "certain invisible and hard-to-measure emissions," and stated that control devices now in the laboratory stages were showing promise. "Should any become practical enough to be put into production, they will of course be marketed," Mr. Williams said. He indicated that the automobile industry as a whole is spending about $1 million per year on research in air pollution control.

General John J. Hull, President of the Manufacturing Chemists' Association, said that for the chemical industry "the avoidance of air pollution and the proper use of air is a condition of doing business." "Chemical producers know from the outset that many of the substances they use or produce are hazardous in some way," General Hull said. "Therefore, safety of employees, neighbors and customers must be a primary consideration." He estimated the industry's expenditure for air pollution control or avoidance at from $200 to $250 million yearly. Development of new processes was cited as a major tool in reducing air pollution, sometimes resulting in profitable by-product recovery. General Hull referred to two publications of the Manufacturing Chemists' Association, an Air Pollution Abatement Manual and "A Rational Approach to Air Pollution Legislation", as other contributions made by the industry.

Dr. Jerry McAfee of the American Petroleum Institute stated that the petroleum industry "recovers about 1,600 tons of sulfur daily which would otherwise escape to the atmosphere." He stressed the contributions of the industry to important air pollution research projects in identifying and measuring pollutants, studying their effects, and developing control methods. In regard to odor control, Dr. McAfee said that "Throughout the petroleum refining industry the philosophy is being adopted that refineries don't have to smell bad." Since 1956, the industry has spent some $66 million on air-pollution control, Dr. McAfee stated. He called for "cooperative effort of everyone concerned: Industry, government, scientists, and the private citizen."

# GROUP DISCUSSIONS

Each of the six discussion groups heard a series of prepared papers and then following discussion of these and other topics, developed recommendations based on the questions submitted by the Inquiries Committee.

In this section of the report, highlights from the formal presentations are noted first for each group, followed by a brief summary of significant points raised in the general discussion. The group reports are given in their entirety in the succeeding section of the report.

## GROUP A—Extent of Air Pollution

The only type of air pollution that has been continuously monitored over a period of years in the United States is dustfall, for which records of 25 years or more exist in a number of cities. Until 1956, only 194 of the estimated 10,000 communities with potential air pollution problems were making any effort to monitor their air, and only 111 of these had a continuing program. Today, perhaps 400 cities collect some sort of air pollution data.

Monitoring of the air is important for four reasons: to signal the presence of air pollution; to identify its sources; to show trends in pollution levels; and to give warning of pollution emergencies. About $1.5 annually is now being spent each year on monitoring programs. But despite this effort and investment, virtually all areas are under-monitored.

To reduce monitoring costs and improve effectiveness, more research is needed on monitoring techniques, on control equipment, and on analysis designed to pinpoint the specific pollutants that are hazardous. A few millions spent for such research now should result in ultimate savings of many times the research investment by making possible the development and operation of more effective monitoring and control systems.

The National Air Pollution Sampling Network as it is now conducted has two major shortcomings:

1. It collects average, cumulative exposures but does not include data on peak exposures. Collection of peak period data would add to the cost, but would yield more valuable information about hazardous conditions.

2. An even greater shortcoming is that the Network now collects only particulate matter, not gaseous substances. The soot, grit, and other visible pollutants in urban air have been steadily diminishing due to technological progress in industrial production and in air pollution control techniques, but the atmosphere is loaded with a greater variety and quantity of gases than ever before. Many gases give no warning of impending danger. Some with warning odors have the companion characteristics of paralyzing the sense of smell after prolonged exposure and thus are undetected by the time they build up to hazardous levels. Only the collection and analysis of gaseous pollutants can reveal such hazards.

## SPEAKERS: GROUP A

1. When is Air Polluted and Why is it Necessary to Measure Pollutants?—Dr. Arie J. Haagen-Smit
   Professor of Bio-Organic Chemistry, California Institute of Technology
2. Identifying and Measuring Pollutants in Community Atmosphere—Dr. William E. Scott, Franklin Institute Laboratories for Research and Development, Philadelphia
3. Changes in Identity and Quantity of Pollutants, Past and Future—Arthur C. Stern
   Chief, Air Pollution Research Staff, Public Health Service
4. Are Sampling and Analysis Techniques Adequate for Today's Needs?—Dr. Morris B. Jacobs, Director, Bureau of Laboratories, New York City Department of Air Pollution Control
5. Are Monitoring Programs Adequate?—Dr. James P. Lodge, Jr., Air Pollution Engineering Research Staff, Public Health Service
6. Can Standard Methods be Established?—Dr. Jacob Cholak, Professor of Industrial Health, College of Medicine, University of Cincinnati
7. Effects of Topographic and Meteorological Conditions on Distribution of Air Pollutants—Dr. E. Wendell Hewson, Civil Engineering Department, University of Michigan
8. Interreactions of Air Pollutants in the Atmosphere—Dr. Lewis H. Rogers, Air Pollution Foundation, San Marino, California

Advances in chemistry have made it possible to determine the type, amount and concentration of gases in the air, but relatively little application is being made of this knowledge and even less is being done to relate chemical data to physiological effects.

We know something about the levels of sulphur dioxide, fluorides, lead, arsenic compounds and other pollutants that affect crops or livestock and therefore we should be able to set standards for them. Setting standards on the basis of damage to human health, however will require more adequate research knowledge on the effects of specific pollutants.

More trained and capable personnel as well as better research instruments are needed for both collection and analysis of air samples, since there is wide variation in the chemical problems which each pollutant source presents.

To date, only two types of air pollution conditions have produced clearly demonstrable acute effects on humans. The first is typified by London smog, and the second by Los Angeles smog.

The London type which occurs in cold, foggy weather, has been responsible for nearly all of the lethal air pollution episodes.

The Los Angeles type occurs on hot, sunny days, and the most apparent effect on humans is eye irritation. The primary effects of this type of smog are caused by the products of the photochemical reactions of organic matter and nitrogen oxides. Much more work needs to be done to understand these photochemical reactions, the products they produce, and the health effects of long-term exposure to low-level concentrations of them.

From our current measurement of the extent of air pollution, we now know that the cleanest air is desert air; that mountain and forest air is twice as polluted as desert air and farmland air three times as polluted. Even the cleanest air in urban communities is five times as dirty as the air in any non-urban area.



Discussion

The time factor is extremely significant in air pollution monitoring, and has not been taken into account sufficiently. In addition to average concentrations, it is important to know peak concentrations and also the persistence of high levels of pollution over a protracted period.

The potential danger of sulphur oxides in the atmosphere converting to toxic sulphuric acid under certain conditions was stressed by one participant. Another participant urged that natural allergens should be included in any discussion of community air pollution, especially since some of them, notably ragweed pollen, are subject to control.

Interpreting the results of monitoring and air pollution surveys is difficult and will require additional knowledge. It is considerably easier to determine the concentration of sulphur dioxide in the air, for example, than it is to say whether, and to what extent, this concentration is harmful. Establishment of air pollution indexes based on single pollutants or combinations is an important goal.

Dr. Arie J. Haagen-Smit

## Group B—Sources of Air Pollution

### Domestic and Municipal

The air pollution caused by individuals and by municipal services, such as refuse disposal, may account for as much as a third of the total air pollution of a city or as little as 7 percent, depending upon how extensively existing knowledge of control procedures is applied to these activities.

Space heating and refuse incineration are the major sources of pollution from domestic and municipal services. Gas heating contributes less air pollution than other methods; oil heat produces some gaseous pollution, notably oxides of nitrogen and sulphur and organic substances; coal, however, is the principle source of pollution caused by space heating. In Louisville, Kentucky, for example, although only about a third of the homes are heated by coal, they contribute 83 percent of the gaseous and 99 percent of the solid pollutants emitted by all home heating equipment.

Apartment house and home incinerators are other important sources of domestic pollution. This source could be markedly reduced by the use of double chamber incinerators with auxiliary fuel applied to both chambers. Such incinerators are now available for apartment houses.

Open burning refuse dumps are a principal source of municipal pollution. Landfills can eliminate this in communities where space for landfills is available. Where landfills are not feasible, communities can solve this problem by using modern incinerators which permit controlled, high temperature combustion. The open burning dump will probably be outlawed in most States in the not too distant future. Another important source of air pollution from municipal sources—the sewage treatment plant—can be controlled through proper plant design.

### Industrial

The industries that rely heavily upon coal—notably electric power companies and iron and steel plants—face difficult air pollution problems but have made great progress in controlling them.

## SPEAKERS: GROUP B

1. Domestic and Municipal Sources
   Dr. Rolf Eliassen, Professor of Sanitary Engineering, Massachusetts Institute of Technology
2. Industrial Sources
   (a) Petroleum
   Gerald Fisher, Los Angeles, Chairman, Technical Subcommittee, Western Oil and Gas Association
   S. Smith Griswold, Control Officer, Los Angeles County Air Pollution Control District
   (b) Electric Power
   (1) Gas and Oil
   W. L. Chadwick, Vice President, Southern California Edison Company, Los Angeles
   Dr Arie J. Haagen-Smit
   Professor of Bio-Organic Chemistry, California Institute of Technology
   (2) Coal
   Arthur A. Orning, Pittsburgh, Chief, Combustion Section, U. S. Bureau of Mines
   (c) Metallurgical
   Thomas C. Wurts, Pittsburgh, Director, Allegheny County Bureau of Smoke Control
   (d) Chemical
   Dr. E. M. Adams, Associate Director, Biochemical Research Department, Dow Chemical Company, Midland, Michigan
3. Transportation—Panel Discussion
   Charles M. Heinen, Highland Park, Michigan, Assistant Chief Engineer, Materials Laboratories, Chrysler Corporation
   Charles A. Jones, Wilmington, California, Executive Secretary, Smoke and Fumes Committee, American Petroleum Institute
   Dr. Leslie A. Chambers
   Research Division, Los Angeles County Air Pollution Control District

The National Air Sampling Network tests the air throughout the Nation Currently there are 112 urban and 49 non urban stations
Non urban Florida Keys
Washington D.C.

Of the 444 million tons of coal used in the United States during 1957, the electric power producing companies used 37 percent. In plants without dust collecting equipment, as much as 80 percent of the flyash produced by this consumption goes into the air as pollution. With modern dust collection equipment this has been reduced to about 10 percent, and could, with full application of existing knowledge, be reduced to about 2 percent.

Iron and steel mills, until a few years ago, were notorious for their air pollution. Aviators used to report that they could follow the smoke cloud from a single mill for 300 miles. However, with electrostatic precipitators, decreasing use of Bessemer converters, and various other measures, this pollution has been drastically reduced in some areas. Problems still to be solved by the industry include: how to control the effluent from electric furnaces; how to prevent blast furnace "slips"; better ways of coping with pollution produced in pushing and quenching coke; and cheaper ways of controlling effluents from open hearths.

The chemical industries, which can be said to include industries using chemicals as well as those producing them, are a growing source of air pollution because new products and new processes are constantly being developed. The industries vary so greatly in nature, size and location that it is difficult to develop standardized control procedures although some progress is being made. More knowledge about the amounts and kinds of pollutants these industries contribute is urgently needed. In specific localities and circumstances, a number of chemical operations cause air pollution problems—e. g., sulphur trioxide, solvents, varnish fumes, and the like.

## Transportation

The transportation industry's greatest pollution problem is the exhaust emitted from the tailpipe of the automobile. Although the public is more aware of the smoke and odors emitted from diesel engine buses, trucks and trains, these are relatively minor sources as compared to automobile exhausts.

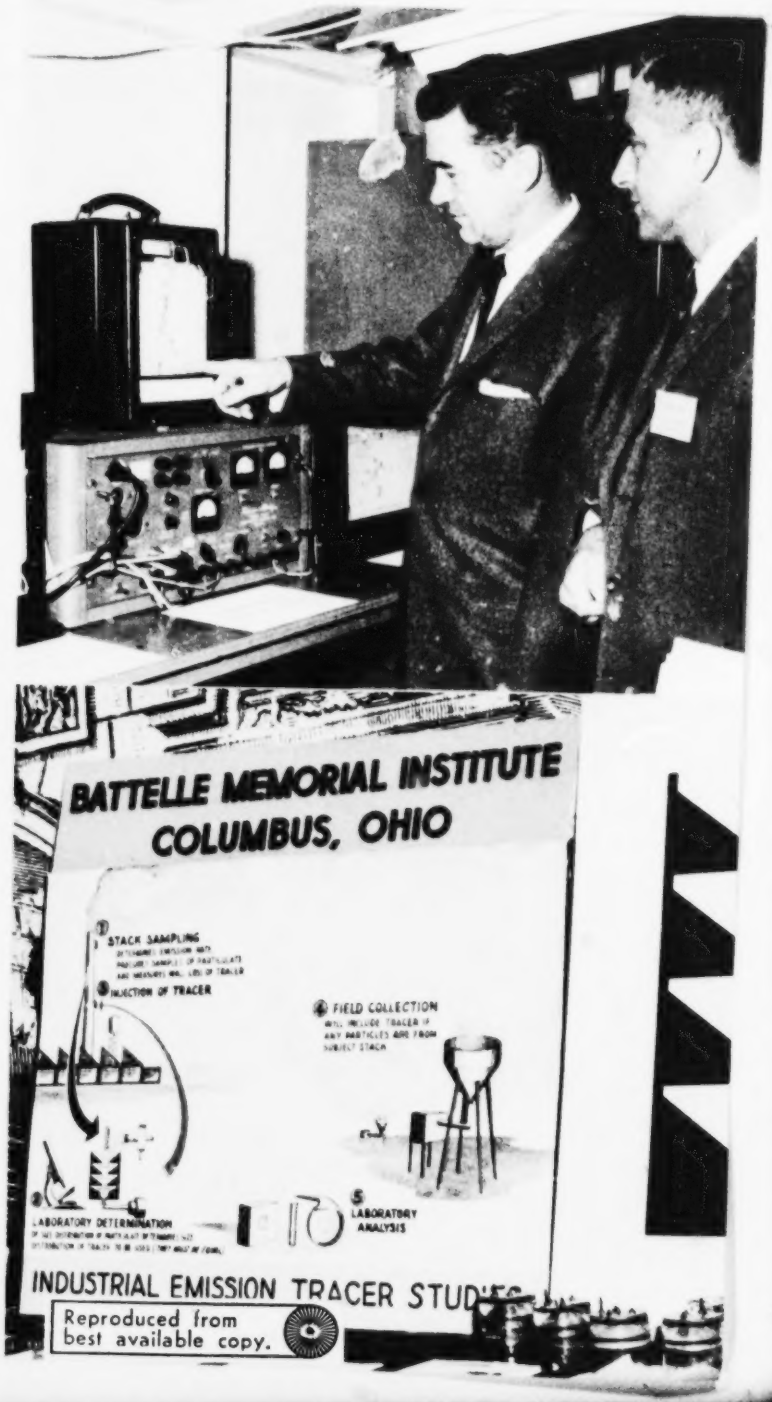
The most significant emissions from automobile exhausts are carbon monoxide, oxides of nitrogen and organic substances. The latter two are the major cause of the Los Angeles smog and are a problem of growing importance in many other cities. There are probably

several thousand organic components involved, which have varying effects on eye irritation, toxicity, plant damage and visibility. More needs to be known about the individual components of exhaust emissions and the meterological factors which govern the formation of reaction products. Satisfactory methods of reducing this pollution have yet to be developed, although the automobile industry has made some progress in achieving better combustion and thus reducing the amount of fuel that escapes into the air.

## Discussion

The assertion that changes in fuel composition would have no appreciable effect on air pollution manifestations was discussed at some length, in the sense that existing evidence is not conclusive and should be explored further. The economic problem involved in installing control devices on automobiles was discussed, and the hope was expressed that a less costly solution or partial solution might be found.

The need for specific quantitative information on pollution emissions was repeatedly stressed, as was the need to translate existing information into language understandable to the laymen.

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## SPEAKERS: GROUP C

1. Exposure to High Concentrations of Air Pollution
   (a) Health Effects of Acute Air Pollution Episodes—Dr. William F. Ashe, Professor of Preventive Medicine, Ohio State University College of Medicine
   (b) Discussion of Dr. Ashe's Presentation—Dr. Robert A. Kehoe, Kettering Laboratories, University of Cincinnati
2. Exposure to Low Concentrations of Air Pollution
   (a) Health Effects From Repeated Exposure to Air Pollution—Dr. Lester Breslow, Chief, Bureau of Chronic Disease, California State Department of Public Health
   (b) Discussion of Dr. Breslow's Presentation—Dr. Leonard M. Schuman, Professor of Epidemiology, University of Minnesota School of Public Health
   (c) Chronic Bronchitis in Relation to Air Pollution in Great Britain—Dr. Geoffrey C. Carey, Department of Preventive Medicine, University of Cincinnati College of Medicine
   (d) Discussion of Dr. Carey's Presentation—Dr. James L. Whittenberger, Assistant Dean, Harvard University School of Public Health



## GROUP C : Health Effects of Air Pollution

Although man has long attributed dire ills to air pollution, real proof that it causes illness in the general population was lacking until recent years. Unequivocal evidence of acute illness has been established in at least three epidemic episodes: in the Meuse Vally, Belgium, in 1930; in Donora, Pennsylvania, in 1948; and in London, England, in 1952.

The effects in all three episodes were similar. Among healthy people, the onset of illness was abrupt. Symptoms included burning sensations in the eyes, nose and throat, coughing, shortness of breath, wheezing, chest constriction and often nausea and vomiting. The chronically ill, suddenly and without apparent cause, developed more serious symptoms and, in some cases, died. Most of the deaths were among the chronically ill.

Although intensive studies were made *after* these occurrences, it was not possible to implicate specific contaminants; in fact, the list of possible contaminants in the three areas varied widely. Given the proper geographic, meteorological, and industrial conditions, such episodes could occur almost anywhere. However, because the conditions which crate episodes of acute air pollution illness are now predictable, such disasters might now be prevented in certain circumstances.

The long term effects of lower levels of air pollution are more difficult to identify. Chronic diseases are so insidious in their onset (some are believed to have a latent period of 20 or 30 years), and causative mechanisms are so subtle, that decades may elapse before a cause and effect relationship can be established.

### Epidemiological Studies

Evidence has now accumulated which suggests that air pollution may be involved in a number of diseases of the respiratory tract. Physicians in Great Britain have established a definite connection between air pollution levels and chronic bronchitis, a disease which is far more prevalent in that country than in ours. General practitioners in England estimate that 10 percent of their workload is devoted to this disease. Deaths from chronic bronchitis in the 45-65 year age group are significantly related to smog conditions and population density.

In California, the death rate from emphysema has risen from 1.5 per 100,000 in 1950 to 5.8 per 100,000 in 1957. Part of this 400 percent increase is probably due to better diagnosis. It is significant, however, that for the country as a whole the emphysema death rate is about twice as high in cities as in rural areas. There is a widespread belief among physicians, as yet not completely proved, that air pollution plays an important role in this disease.

The recent rise in deaths from lung cancer in the United States is also more marked in urban than in rural areas. This excess increases in proportion to the size of the city and appears to be unrelated to smoking habits. The lung cancer death rate among white males is twice as high in cities as in rural sections. Since the latent period for cancer seems to extend over many years, the establishment of cause and effect relationships by epidemiological means is very difficult.

Large scale epidemiological studies should be conducted to determine differences in chronic disease incidence among communities having various intensities of air pollution. Also needed are more studies of single disease entities prevalent in certain areas, such as "farmer's lung" in Wisconsin, asthma in Yokohama and New Orleans; and others.

## Laboratory Studies

Laboratory experiments have demonstrated that carcinogenic materials are in the air in particulate form which makes it possible for them to be inhaled and deposited in the lining of the lung. Some of these agents have produced skin cancers and subcutaneous sarcomas in mice.

Ozonized gasoline has been used in inhalation chambers for the production of lung tumors in mice. These tumors differ structurally from human tumors but are unmistakably new growths.

Atmospheric irritants of all types, though in themselves not cancer-producing, may play a role in the development of cancer by interfering with normal flow of the mucous stream. It is this continual flow that normally prevents accumulation of deposited material on the lining of the lung.

## SPEAKERS: GROUP C

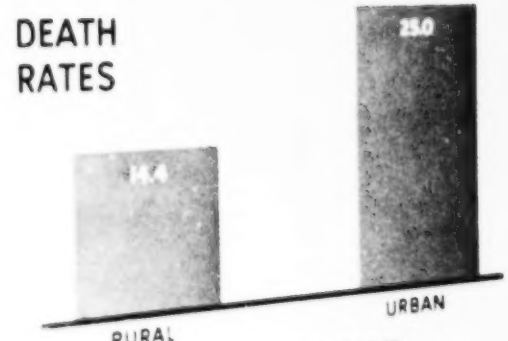
3. How Air Pollution Has Its Effects on Health
   - (a) The Irritant Action of Air Pollutants—Dr. Norton Nelson, Director, New York University Institute of Industrial Medicine
   - (b) Air Pollution and Lung Function Changes—Dr. John R. Goldsmith, Head, Air Pollution Medical Studies, California State Department of Public Health
   - (c) Discussion of Dr. Goldsmith's Presentation—Dr. Julius H. Comroe, Jr., Director, University of California Cardiovascular Research Institute
4. The Relation of Air Pollution to Cancer
   - (a) Air Pollution and Cancer—Dr. Thomas F. Mancuso, Chief, Division of Industrial Hygiene, Ohio Department of Health
   - (b) Experimental Tumor Production with Air Pollutants—Dr. Paul Kotin, Associate Professor of Pathology, University of Southern California School of Medicine
   - (c) First Discussion of Dr. Mancuso's and Dr. Kotin's Presentations—Dr. J. R. Heller, Director, National Cancer Institute, Public Health Service
   - (d) Second Discussion of Dr. Mancuso's and Dr. Kotin's Presentations—Dr. Dean F. Davies, representing American Cancer Society, New York City

Tests with patients suffering from respiratory ailments have shown that the functioning of their lungs improves and their symptoms decrease when they are moved out of polluted air into a room with filtered air. Other experiments have shown that on exposure to ozone levels of .37 parts per million for five minutes, a clearly observable increase in airway resistance to breathing results.

Discussion:

Seventy percent of Los Angeles physicians responding to a questionnaire stated that their patients were adversely affected by smog episodes. In general, however, there is more concern about the chronic effects than about the acute effects of air pollution.

Voluntary agencies can give important support to public agencies in stimulating research and promoting public and professional education. Professional societies have an important responsibility in undergraduate and post graduate training for prevention of air pollution related diseases. Appropriations for air pollution research at all levels of government should be higher because of the many problems to be attacked simultaneously.




LUNG CANCER

In each breath of urban air there are thousands of foreign particles as well as gaseous pollutants

## GROUP D : Economic and Social Effects

There has been a prevailing symbolic belief, in the past, that factories mean smoke and ugliness which in turn create slum conditions. Such symbols die hard. Actually, most industrial plants built within the past decade are very different from the old factories which gave rise to the popular concept. More and more they use smokeless fuel and discharge few obvious pollutants to the atmosphere. In contrast to older industries, most modern plants cover only 5 to 10 percent of the lot on which they are built. Such industry tends to enhance property values greatly in areas where it locates.

Industry is indispensable to most communities. It also creates problems, inevitably—traffic congestion, noise, and others as well as air pollution. Some industries continue to be blighting influences in their immediate areas. Planning and zoning are important in obtaining the benefits of industry while minimizing the ill effects.

The contrast between our high standards of cleanliness inside our homes and our tolerance of unsightly and unhealthy conditions in the community air was stressed. An intensified program of public education, designed to bring the facts on air pollution and what can be done to control it to the attention of the public and especially of the Nation's women, would help to remedy this situation.

Agriculture suffers extensive damage from air pollution in California, Oregon, Washington, Montana, Idaho, Utah, Tennessee, Florida, New Jersey, and several other States. The loss has been estimated at upwards of $5,000,000 per year in the Los Angeles area alone. Such damages range from total loss of crops or livestock to slight reduction in yields. Evaluating just compensation for these losses is difficult. To date they have been evaluated individually in courts, often over a period of years during which time certain agricultural activities may actually disappear from a region. One location in the State of Washington supported more than 2000 dairy cows prior to establishment there of an industrial plant; while the suits have been before the courts the number of cows has been reduced to less than 100.

Agriculture also contributes to air pollution through dust resulting from soil erosion, through spraying activities with herbicides and insecticides, and through processing of certain agricultural products.

One chemical, fluorine, causes the highest percentage of total losses to agriculture. Court cases during 1956, in various parts of the country, involved losses up to $50 million from fluorine alone. Much more research is needed to attack this problem successfully.

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## SPEAKERS: GROUP D

**Program**

1. Impact of Air Pollution on Our Economics
   (a) Industrial and Community Development and Property Values—Dennis O'Harrow, Executive Director, American Society of Planning Officials, Chicago
   (b) The Homemaker's Viewpoint—Miss Chloe Gifford, President, General Federation of Women's Clubs, Washington, D. C.
   (c) Agricultural Considerations—Charles Butler, Director, Land and Water Use Department, American Farm Bureau Federation, Washington, D. C.
2. Impact of Control Programs for Air Pollution on Our Economics and Society
   (a) Industrial Investments, Taxation, and Community Relations—Frank L. Seamans, of Eckert, Seamans & Cherin, Pittsburgh
   (b) Byproduct Recovery and Development—William R. Bradley, Assistant Director, Environmental Health, American Cyanamid Company, New York City
   (c) Community and Social Implications—Dr. Robert A. Nisbet, Dean, College of Letters and Science, University of California, Riverside

For industry, recovery of a saleable by-product is the ideal solution to air pollution problems. Unfortunately, such solutions have not been found for a large number of industries. However, there are examples, such as:

1. Leftovers from antibiotic production, once a disposal problem, are now added to animal feed supplements.

2. A $12 million investment in air pollution control by twelve industries in Perth Amboy, New Jersey, has resulted in considerable financial return, including recovery of 8,000 tons of sulphur per year in one plant.

3. A steam-stripper installed at a cost of $85,000 to remove benzothiazole now recovers about $50,000 worth of benzothiazole annually.

4. One company recovers liquid chlorine from air-chlorine mixtures at a cost of about $19.00 per ton compared to a market price of over $60.00 per ton.

5. A market is developing for fly ash from coal burning. A large power company sold 105,000 tons of fly ash in 1957, at $1 per ton, for use as mineral filler in asphalt paving and in the manufacture of cement products.

In the area of stimulating public support for air pollution control activities, the public is difficult to mobilize because other more obvious problems often exist side by side with air pollution. The group most likely to take an active part in antipollution campaigns is the upper middle class, for whom many of these "competing" problems are already solved. This group, historically, has been the leader in community betterment projects of various kinds. In the case of air pollution, an appeal to this group on the basis of "decency", "neighborhood pride" and esthetic considerations may prove more effective than either the health aspects or the economic phase of the problem.

## Discussion

The statement that in general air pollution is lessening was challenged and discussed at length, the consensus appearing to be that while some types of pollution have perhaps diminished somewhat, the over-all problem is probably growing more serious. Specifically, damage to plants from products of photochemical reactions, once thought to occur only in the Los Angeles area, has recently been found in San Diego, San Francisco, Philadelphia, Detroit and elsewhere, and appears definitely to be increasing year by year.

There was considerable debate as to the adequacy or inadequacy of the automobile industry's $1 million annual investment on air pollution research as compared with other expenditures of the industry.

There was general agreement that reliable economic data on air pollution is scarce and difficult to obtain, and that more intensive study should be undertaken in this field.

It was stated in discussion that a much greater amount of money has been spent on air pollution abatement "motivated by a sense of doing the right thing" than that spent for economic gain through by-product recovery.

## GROUP E : Control Measures and Procedures

Standards of air quality are governed by what the public wants and is willing to pay for. The minimum standards are dictated by health effects, the maximum by aesthetic considerations.

The first step in control is to assess the nature and quantity of pollutants involved. Knowledge of the quantities and types of all pollutants is so important that, even if a community has only one engineer in its control program, it is worthwhile to budget part of his time for industry-wide source studies. Employment of private consultants for surveys, which might be at least partially financed by industries, is another resource for the smaller community. Where surveys or investigations would yield data useful to other areas, Federal assistance may be desirable.

The second step in control is to determine how much contamination it is necessary to eliminate. This means that the costs of control must be weighed against the effects of the pollution and a practical balance struck. Difficult at best, this determination is made still more difficult by the fact that information about feasible measures is not always known by those who could apply it or call for its application. Actually, the lack of personnel who know and can apply theoretical and empirical data which already exist is as important an obstacle to better control programs as lack of knowledge itself. Problems of air and gas cleaning should be included in more graduate mechanical and other engineering courses, and chemists as well as engineers should become more familiar with the growing body of literature on aerosol technology.

It is most important, of course, that both air pollution control officials and industrial personnel have a thorough understanding of control equipment and techniques and what they can accomplish. Too often, industry has made costly investments to control its pollution, only to find that the installations did not achieve the objectives called for.

The specific control measures adopted should be determined by the findings and decisions that result from steps one and two. Broadly speaking, there are three approaches: to control the operation or production process so that less pollution is generated; to install control equipment to prevent the contaminants from being discharged into the air; and to erect high enough stacks so that the pollutants will be diluted with air before they descend to ground level.

Progress is being made in the procedures and equipment for each of these approaches. For example:

Oil refineries spent about $20 million in 1958 to install smokeless flares, raise the height of stacks, prevent tank vapor losses, recover sulphur that would otherwise go into the air as sulphur oxides, and institute other improvements.

The Manufacturing Chemists' Association estimates that air pollution control in the chemical industry, on a company basis, totals about 1 to 1½ percent of all production costs. Although some valuable byproducts are recovered, their value is small compared to the cost of control.

## SPEAKERS: GROUP E

1. Engineering Control of Air Pollution—Dr. Charles E. Lapple, Stanford Research Institute, Menlo Park, California
2. Criteria for Selection of Methods of Control—Andrew H. Rose, Jr.
   Air Pollution Engineering Research Staff,
   Public Health Service
3. Economic Aspects of Engineering Control
   (a) Oil and Chemical Industries—L. C. Burroughs, Assistant to Vice President, Shell Oil Company, New York City
   (b) Fuels Industries—Harry C. Ballman, Manager, Field Engineering Services, Bituminous Coal Institute, Washington, D. C.
   (c) Land Disposal and Incineration—F. R. Bowerman, Division Engineer, Los Angeles County Sanitation Districts
4. What Needs To Be Done in the Future
   (a) Application of Present Knowledge—Wesley C. L. Hemeon
   Air Pollution Research Consultant,
   Hemeon Associates, Pittsburgh
   (b) Improvement and Development of Control Methods—Dr. Leslie Silverman
   Professor of Industrial Hygiene Engineering;
   Harvard University

## SPEAKERS: GROUP E

5. Extent to Which Available Control Techniques Have Been Utilized
   (a) Industry
      (1) Chemicals—William R. Chalker, E. I. du Pont de Nemours & Company, Wilmington, Delaware
      (2) Iron and Steel—Walter O. Everling, Director of Research, American Steel and Wire Division, United States Steel Corporation, Cleveland
      (3) Oil—L. C. Burroughs
      (4) Power—G. V. Williamson, Superintendent of Power Production, Union Electric Company of Missouri, St. Louis
      (5) Automobiles—James M. Chandler, Ford Motor Company, Dearborn, Michigan
   (b) Community
      (1) Los Angeles County—Robert L. Chass, Los Angeles County Air Pollution Control District
      (2) Philadelphia—P. Walton Purdom, Director, Division of Air Pollution Control and Environmental Sanitation, Department of Public Health
      (3) Milwaukee—John E. Brown, Air Pollution Control Engineer, Department of Smoke Regulation, Milwaukee County

About 20 percent of all air pollution equipment sold reportedly, is purchased by the chemical industry.

The iron and steel industry consumes billions of tons of air annually in its production processes and, in order to return this "borrowed" air in good condition, is constantly developing and adopting new procedures and devices.

Electric power plants have eliminated many of the smoky stacks that once characterized their central station boilers. Many of them collect 90 to 99% of their fly ash before it reaches the atmosphere and, in areas where they do not constitute aviation risks, stacks as high as 750 feet have been built to dilute effluent gases. Problems related to the discharge of sulphur and nitrogen oxides remain, however, and will require further research to solve.

The auto industry has established eight industry panels to work on air pollution research problems: an induction system panel to develop devices to prevent unburned hydrocarbons from entering the engine exhaust system; an exhaust system panel to develop devices for removing unburned hydrocarbons in the exhaust; and others concerned with traffic surveys, carbon monoxide, visible smoke emissions, exhaust system engineering, medical aspects, and data analysis.

Much of the research done by all industries is carried out by their trade associations and is thus supported by the entire industry. This has proved an effective approach which is often more acceptable than having each company attack these common problems on an individual basis.

### Discussion

There was considerable discussion, both pro and con, of the newly adopted rule in Los Angeles restricting the burning of fuel oil containing more than 0.5 percent of sulphur by weight. It was pointed out among other things that the rule would change the economy of energy in the Los Angeles area. Means of reducing odors at petroleum refineries were also discussed at length. It was asserted that one refinery had recently spent $1 million, with no return whatsoever, on odor control alone.

As in other groups, the difficulty of establishing maximum allowable concentrations of sulphur dioxide, hydrogen sulfide and other pollutants was stressed.

## GROUP F Administrative Aspects

In general, the administrative responsibilities of the various levels of government should divide somewhat as follows:

The Federal government, as representative of all citizens and with first call upon tax revenues, is the logical organization to perform or finance most publicly supported research projects and special studies and to disseminate information appropriate to the needs of each of the many groups and disciplines involved in air pollution control.

State governments are admirably equipped to assess problems and perform developmental work on devices and processes specific to their respective areas. Such work is too expensive for local agencies whereas the Federal research effort should not be diluted by this type of developmental project.

Local agencies are best able to assess their own problems, determine the most suitable control methods, and adopt and enforce regulations.

However, where problems extend beyond jurisdictional lines, the administrative pattern must be adjusted accordingly. Interstate control can probably best be achieved by cooperation between neighboring States, with regulations adapted to local conditions, rather than by trying to enact standard regulations applicable to all areas. State legislation for interstate compacts should provide for an interstate commission which would be responsible for collecting and disseminating information; act as coordinator between the air pollution control agencies of the signatory States; conduct field studies; and promulgate and enforce interstate rules and standards. Since the entire Eastern seaboard, from Massachusetts to Virginia is virtually an unbroken urban complex blanketed by a single air mass, an interstate compact involving all these States merits consideration.

The Upper Ohio Valley is an illustration of the administrative problems involved when air pollution problems extend beyond State and municipal boundary lines. Extending along 80 miles of the Ohio River and involving two States, eight counties and over 20 municipalities, this area has been described as one of the eight most seriously polluted sections of the Nation. The Ohio Valley Air Pollution Control Council was incorporated in January 1958, and is supported entirely by dues from its 100 members. The Council classifies the air pollution problems of the cities and industries in the area; furnishes technical aid in solving these problems; and advises on the development and enforcement of uniform ordinances throughout the area. Although this pioneer effort at interstate action has made initial progress, its proponents believe that it should be reinforced by an Interstate Compact, supported by the Ohio and West Virginia legislatures and approved by the U. S. Congress.

The value of involving the general public in community air pollution control policies and plans is illustrated by the Philadelphia program. The city's air pollution control

## SPEAKERS: GROUP F

1. How Can Community Sentiment on Air Pollution Problems Be Determined and Community Action Initiated?—Donald C. Wagner, Managing Director, City of Philadelphia
2. Levels of Responsibility for the Administration of Air Pollution Programs—Harold W. Kennedy Los Angeles County Counsel
3. Industries' Participation in Air Pollution Programs—Howard F. Roderick, Vice-President, International Minerals and Chemical Corporation, Chicago
4. Achieving Balance in Air Pollution Activities Through Education, Voluntary Action, Legal Enforcement, and Budget—Dr. Leonard Greenburg, Commissioner, New York City Department of Air Pollution Control
5. The Proper Role of Planning and Zoning in Air Pollution Control—Dr. Richard May, Jr., Raymond and May Associates, White Plains, New York
6. Solving Interstate Air Pollution Problems—Walter S. Cooper, Special Counsel, Interstate Sanitation Commission, New York City
7. Sources of Information on Air Pollution—Benjamin Linsky, Air Pollution Control Officer, Bay Area Air Pollution Control District, San Francisco

code was thoroughly reviewed, before adoption, by representatives from industry, the Chamber of Commerce and leading civic organizations. The individual regulations which implement the code are drafted by technical staff and then reviewed and modified by an advisory committee and its subcommittees which include representatives of the affected industries and community leaders from all walks of life. This means that the regulations are well understood and widely supported. The success of the method is indicated by the fact that during the past six years, Philadelphia has eliminated open burning dumps, coal burning engines, black industrial stacks, initiated a multimillion dollar incinerator program, and guided industry in making major pollution control installations.

Industry, as well as the official control agency, should participate in educational programs. The public should know what local industries are doing. Also, if properly informed, industries will usually see that new installations are designed to keep pollution to a minimum. Similarly, a well-informed public will support reasonable measures which do not place an unnecessary economic burden on industry and which, at the same time, prevent unnecessary contamination of the air. A community's education program should reach everyone from school children to adults, from private citizens to the owners of large establishments.

A major reason why air pollution is not better controlled is that most people, including even the specialists, do not know how much it is practical to do. For example, in one area where there was much pollution from cement plants, community leaders were preparing to ask for Federal aid for research on a certain aspect of the problem. Only on the day they were to present their testimony to Congress did they learn that the answer to that problem was known and was already being applied by cement plants in other areas.

## Discussion

The role of zoning and planning agencies was considered important in the development of new communities or industrial areas, especially through introducing performance standards for air pollution control. It was stated that such standards might be economically and technologically impracticable in communities with serious pollution problems already in existence.

The possible dangers of "pyramiding" authorities in air pollution control through the creation of interstate agencies were mentioned by several participants and discussed; the consensus appeared to be that the value of such agencies in certain areas outweighs any potential problems which they might create.

# SUMMARY SESSION

Addressing the final day's session of the Conference, Secretary Arthur S. Flemming of the U. S. Department of Health, Education, and Welfare declared his intention to work wholeheartedly for renewal and expansion of existing Federal legislation on air pollution which is due to expire in 1960. He said that he would seek such action at the first session of the new Congress to give "all possible impetus" to the current program of research and technical assistance.

Secretary Flemming urged all groups represented at the Conference to help in defining realistic national goals in terms of total expenditures and the proportionate share that should be borne by industry and the various levels of government. "The only way to make progress is to translate our convictions into dollars," Mr. Flemming said. "There is no question but that society is going to have to make a real investment if the problem of air pollution is going to be handled."

"It is one thing to talk in generalized terms of the need for research in this area," Mr. Flemming said. "It is another thing to translate those generalized statements into dollar goals, and then to say to the Federal Government, to State and local governments, and to private groups, 'Here's what you need to do if we are to reach our national goal.'"

Questions from the floor during the Open Forum session served to amplify rather than challenge or contradict the discussion group recommendations, which appeared to receive the tacit approval of the entire assembly.

Among the subjects discussed were the need for more attention to and more adequate information on both agricultural sources and agricultural effects of air pollution; the great potential value of long-term epidemiological studies relating air pollution levels to the general health of an entire city; and the need for accurate and comprehensive data on

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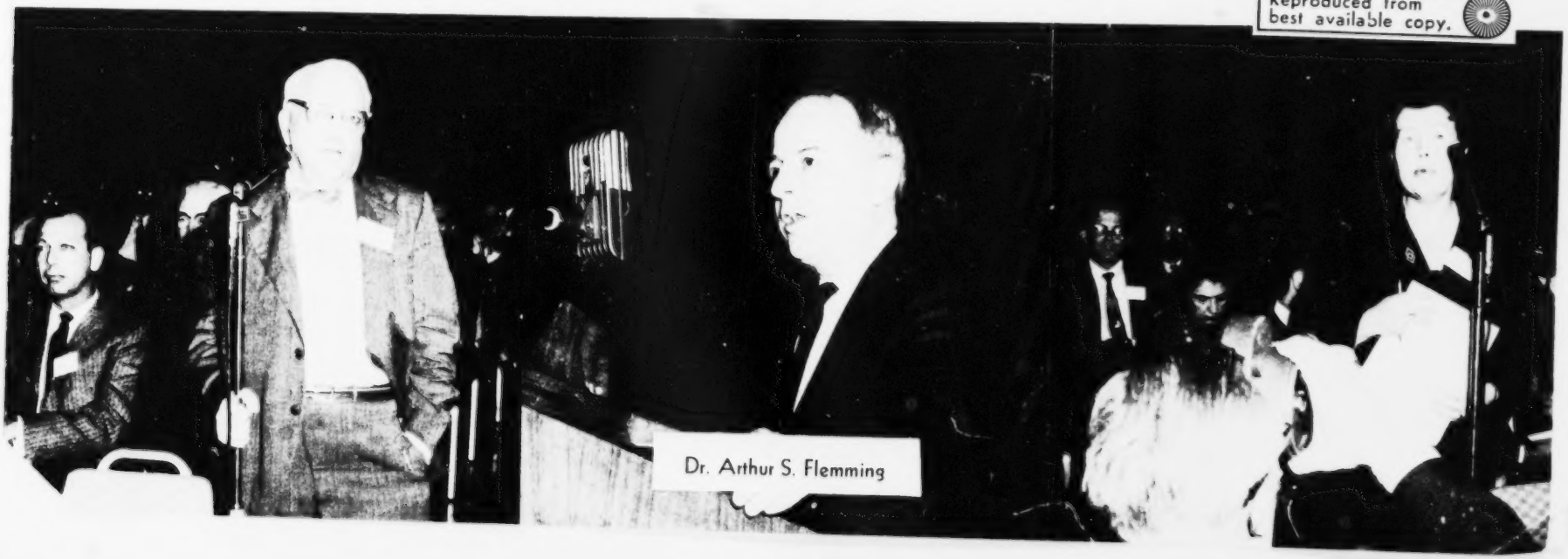

Dr. Arthur S. Flemming

industry's expenditures for air pollution control. The need for close and active cooperation between air pollution control officials and local planning and zoning agencies was clarified and re-emphasized in the Forum discussion. The inadequacy of existing "public nuisance" statutes and ordinances as tools for local pollution control officials was also brought out in discussion from the floor.

Martin Agronsky of the National Broadcasting Company summarized the Conference from the point of view of the general public. He commented that the success of a conference often could be measured, not by the number of recommendations unanimously accepted but rather by the genuine differences of opinion which were brought to light and freely discussed. Among these, he highlighted the controversial issues of the health effects of air pollution and the relative significance of automobile exhausts as being of greatest interest to the public. He underscored Secretary Flemming's insistence on specific goals in terms of "dollar signs and priority listings." He also urged the conferees to act on their recommendation for increased attention to public education and information on air pollution. He mentioned pollution from nuclear weapons testing as a vitally important matter without which "any solution to air pollution problems can only be partial."

"There is a strong tide in this country for better health and a cleaner environment," Mr. Agronsky concluded. "The people will no longer accept push button living in a stinking city. They will see to it that air pollution is controlled. And you can help them."

# REPORTS OF DISCUSSION GROUPS

Following the discussion sessions, the chairman, vice chairman and panel members of each group drafted a report for presentation to the plenary session on the final day of the Conference. The texts of these six reports are reproduced verbatim in the succeeding pages.

## EXTENT OF AIR POLLUTION

I. (a) Where do we stand in our knowledge of

(1) The identity and quantity of pollutants in community atmospheres?

This question is concerned with our ability to apply quantitative measures to pollutants in the atmosphere, rather than to how effectively this ability has been applied to measurements across the Nation. The group of discussants devoted their principal attention to problems concerned with man-made pollutants of a chemical nature rather than with airborne bacteria, pollens, and similar viable pollutants of natural origin. They recognize, however, that these latter pose important problems that need further consideration.

In identifying and measuring general classes of man-made pollutants, knowledge and techniques are available for studying almost any situation which has been found to occur. However, in identifying and measuring the individual substances which go to make up these classes, we are not nearly so fortunate. For example, the total amount of solid material in the atmosphere can be measured in any of several ways. But when it comes to measuring certain specific compounds, means of positive identification are still lacking. Even for the partial identification which is now possible, the procedures are tedious and expensive, and only a few laboratories in the country are equipped to undertake such a task.

Most of the measurement techniques for identifying trace quantities were originally developed for industrial hygiene use, where concentrations on the order of a few parts per million were being measured. Now, in studying community air pollution problems, concentrations in the parts per billion range must be measured.

For a large number of substances, methods have been developed to obtain quantitative results from samples taken for periods of 24 hours or longer. For a small number of the more simple gases such as sulfur dioxide, hydrogen sulfide, and carbon monoxide, for example, methods are available to show the concentration minute by minute. Among the substances which can be measured over longer time intervals, but which we would like to measure minute by minute, are aldehydes, olefins, polynuclear aromatic compounds, and some particular industrial effluents. Since concentration-time relationships are not well understood, studies for a number of different averaging times will have to be made until the relationship becomes classified.

Another disadvantage in applying available methods is the matter of cost. Many of the instruments which are now available cost several thousand dollars apiece, which limits their application to situations where the information is urgently needed. Along with the development of new methods of atmospheric measurement, there is great need to make these methods commercially available at lower cost so that they can be more widely applied. Because of the recent history of the development and application of measuring devices, we have become accustomed to thinking in terms of elaborate devices, to the neglect of simple procedures such as impregnated test papers and other straightforward methods. Such techniques as film badges for workers handling radioactive materials, and the indicator crayon used by military forces to measure exposure to toxic gases could be extended to provide techniques for air pollution investigations. These techniques are all averaging techniques; similar methods responsive to peak concentrations are also needed. These might eventually be used in warning systems.

Most of the methods now in use have been adaptations of methods originally developed for other applications, and borrowed for use in air pollution research studies. Incentives need to be provided for the development of methods specific to the needs of air pollution. Special attention is drawn to gas chromatography as a separation technique, supported by infra-red absorption and mass spectrography for identification purposes.

Even though our ability to identify and measure pollutants is not as far advanced as we believe it should be, it is much further along than our knowl-

edge of the significance of these measurements as they affect the health and comfort of man.

I. (a) Where do we stand in our knowledge of
(2) The trend in change of such pollutants and their pattern of distribution?

The only pollutant for which we have a sufficiently long record of measurement to establish trend is settleable solids. For this pollutant, we know that there was a consistent downward trend for several decades, which has recently flattened out. Sulfur dioxide has been measured for over twenty years in a number of locations, but the results are not available to the public. Fluoride measurements have also been made for over ten years, but the results are likewise unavailable.

Other than these three pollutants, none have been systematically measured for over ten years. The longest record for pollutants, other than fallout, sulfur dioxide and fluorides, is that of the Los Angeles County Air Pollution Control District, where continuous measurement has been made since 1953 of oxidant. Systematic, continuous measurement of carbon monoxide and oxides of nitrogen was started in 1955, when the "alert" system was established.

Analyses of suspended particulate matter by the National Air Sampling Network of the Public Health Service were started on a small scale in 1953; however, for most communities associated with the Network, the starting date is January 1, 1957.

Direct measurements of soiling have been available for several years and are of considerable use in determining progress made in air pollution control.

Thus, it is apparent that long-term trends cannot be established by the data available to the public, for other than settleable solids and soiling index.

A recent survey of the location of continuous, automatic measuring devices for gaseous pollutants showed that 100 of these devices were located in California, 48 were scattered throughout the country in the hands of industrial organizations, and 10 were operated by public agencies outside of the State of California. Thus, it is obvious that data to indicate trends of gaseous pollutants are primarily confined to California. A true national picture of the distribution of suspended particulates has been obtained during the past two years by the National Air Sampling Network. This Network has the limitation of affording only one sampling site in each community, and, therefore, can at best only indicate the general level and type of contamination in the community.

The available measurements of settleable solids and soiling index are primarily from large eastern cities where coal is in widespread use as fuel. Outside of the coal-burning areas, there has not been the public demand for abatement which would lead to the continuous, systematic measurement of gritty and grimy materials in the atmosphere.

The available data show that definite correlations can be established between the type and amount of pollution and such factors as the size of a city, the type of fuel used, types of industry present, common methods of transportation, and other factors related to the patterns of our modern civilization.

I. (a) Where do we stand in our knowledge of
(3) The specific effects of various topographic and meteorological conditions and of concentration or dispersal of sources on the concentrations of such pollutants?

Some knowledge has been available for many years concerning the diffusion phenomena which control the dispersion of pollutants from a point source. Originally developed because of military interest in the spread of a cloud of a toxic agent, this knowledge was later applied to studies of industrial emissions from a single stack. Early in this work, the effects of varying meteorological conditions became evident. One of the most exhaustive studies of pollutants from a point source was completed at Trail, British Columbia, where a complicated meteorological and topographic situation caused widespread pollution throughout an entire valley at certain times. A complete understanding of this situation was necessary before suitable control measures could be developed. The importance of the meteorological phenomenon known as inversion in affecting air pollution situations was first brought to the public's attention as a result of this investigation.

The application of point-source theory to community-wide problems involving multiple sources necessitates a complicated mathematical treatment which is only beginning to be explored. Meteorological measurements at ground level are frequently not sufficient of this purpose, and measurements above ground level are usually even less available. The relationships between meteorology and topography have been under study by meteorologists for many years, and are quite well understood for general flow patterns but not for dispersion of contaminants.

When a combination of unfavorable meteorological and topographic conditions cause air to become stagnant over a community, the possibility is greatly increased that reactions will occur in the atmosphere to produce substances radically different from the materials which were originally emitted. Many of these reactions are not completely understood.

One influence on the concentration of air pollutants may be the dispersal of sources. By applying general principles already known, sources of pollution can often be located relative to prevailing winds and other sources so that adverse effects on the surrounding community can be minimized. In other cases, lack of knowledge concerning a particularly complicated meteorological picture makes proper selection of source location difficult. In still other cases, where winds are extremely light and variable, little can be done from the standpoint of source location.

I. (b) What, if anything, should be done further on these matters, and by whom?

In identifying and measuring pollutants:

1. Effort needs to be expended in development of refined analytical techniques, to identify and measure pollutants which cannot be adequately measured at the present time in the parts per billion range.

2. More inexpensive methods are needed for continuous monitoring.

3. When monitoring pollutants, peak values as well as average concentrations should be determined until relationships are clarified.

In studying trends in change of pollution levels and their pattern of distribution:

1. Particulate sampling, as being done by the National Network, should be continued to study long-term trends.

2. Gas sampling should be initiated to study the distribution of gaseous pollutants throughout the Nation and to establish long-term trends.

3. A National Network based on only one sampling site per community is indequate to determine the distribution of pollutants within any but the smallest communities. This points up the need for the maintenance of monitoring programs conducted by local communities at locations sufficient to define the local problem. This more intensive local sampling should be conducted in such a manner that results can be compared with other communities and with the National Network results.

4. Much useful information could be obtained with little additional work if the results of previous unpublished sampling could be made available.

5. Monitoring programs should be reappraised at regular intervals to be sure that they remain dynamic in character and do not become self perpetuating.

Concerning the effects of meteorology and topography:

1. Existing meteorological knowledge is not being used adequately for the solution of community air pollution problems. Communities should be shown how they can measure and use meteorological data inexpensively and conveniently.

2. Systems of meteorological measurement specific to the needs of air pollution investigations are needed. Most of the present meteorological measurements and observations were established to meet the needs of agriculture, aviation, etc., and do not provide the optimum service to air pollution investigations.

3. Better methods are needed to relate emission concentrations to atmospheric concentration, more particularly for area sources such as cities. Theoretical and experimental studies are urgently required, not only of diffusion at distances of one mile and beyond, but also of the rate of natural cleansing of contaminant gases and particulates from the atmosphere by the processes of washout, rainout, gravitational settling, and turbulent impaction.

4. A better delineation of the air pollution factors responsible for decrease of visibility is needed.

5. There is a need for better and more sensitive tracer techniques, with particular reference to the problems of tracing air movements within an urban area.

6. Recognizing that each community has a limit to the amount of pollution its atmosphere can accept, there is need for more knowledge of the interrelationships between meteorological and topographical factors for the establishment of these limits both for short and long time periods.

7. Atmospheric contaminants such as $CO_2$ which may be causing long period changes in our climate should be monitored on a national basis at appropriate stations.

In historical perspective, the first measurements of air pollution were supported by local governmental agencies. Industrial organizations responded to these initial efforts by initiating studies in their own laboratories and by supporting studies in educational and research institutions. With the advent of the Los Angeles problem, and the organization of air pollution control there on a county-wide basis, major research support for a considerable period of time became a county responsibility, later to be supported by State-sponsored efforts in California. In recognition of the fact that the problem of air pollution extended beyond the confines of California, Federal support of research was sought and initiated. This Federally-supported research has been conducted both directly in Federal laboratories, by contract with research organizations, and by grants to individual researchers. A mechanism has also been developed in California through the establishment of a private foundation whereby funds from industrial sources are made available to support research in private research organizations. It is apparent both that there is no one best agency to support research, and no one best type of research organization to conduct this research. In our future planning, all methods of obtaining support must be tapped, both private and all levels of government. All available research facilities need to be used in the areas of their greatest competence, depending mainly on where competent individual researchers and suitable facilities are to be found. There is a definite need for recruitment and training of additional qualified persons to meet the challenge of modern air pollution problems.

## SOURCES OF AIR POLLUTION

The pollutants which were discussed represented in general the end products of combustion, the products of incomplete combustion, and the emissions of various kinds from process industries. Where quantities of pollutants were known or available, they were reported by the authors, and it is unnecessary to repeat this information here. However, it was discovered that information on the types as well as the quantities of pollutants was not known for all sources, and that many gaps in this information exist largely because of the lack of analytical and test procedures. The panel dealt principally with primary sources of pollution, but it was recognized that secondary pollutants may result from reactions in the atmosphere.

Information on the quantities and types of emissions is basic to the problem of control. This information establishes quantitative objectives for control and identifies substances which are known to affect health, damage property, or create nuisance.

In any locality, the significance of any single pollutant or group of pollutants will depend upon the amount, the topography, the meteorology, and the number of sources involved, as well as the density of the population in the vicinity. Each community is a specialized problem and the pollutants which may be of concern to one geographical area will not necessarily be a problem to another.

There is a need for determining the relationship between the emission rate of a specific pollutant and its effect on the environment. It is desirable to establish tolerance thresholds with respect to effects on health, growing plants and animals, and the creation of nuisances.

The history of technology suggests very strongly that patterns of emission from all sources will change in the future. An example of this is the substitution of nuclear energy for fossil fuels in the production of power. Similarly, technological development continually alters the types of emissions from chemical processing and manufacturing. The precise direction in which these changes will occur cannot be predicted, but the fact that they will occur is certain, emphasizing the need for continuing source appraisals.

The rapid development of urban areas makes the significance of future increases in pollutants particularly important since greater numbers of persons will be exposed to the effluents from these sources.

The opinion was expressed by many speakers that neither knowledge of types of pollutants at their sources nor present methods of analysis is adequate. It was pointed out that in some areas the methods of identifying pollutants are not specific enough. Furthermore, in certain cases where methods are known, they are either too expensive or too time-consuming, or both, and adequate methods for identifying minute quantities of pollutants are not readily available. We believe that there exists a need for knowledge and information on more specific, accurate, less time-consuming and less expensive methods for evaluating pollution sources.

In addition, there exists a need for a systematic compilation of available information on emissions from all sources, as well as a means for improved communication and dissemination of this information as it is developed.

We do not believe that the development of these improvements is the sole responsibility of any one agency, group, or individual, but that what is needed is the coordination of the efforts of all groups who are interested in this problem. By this we mean that industry and manufacturers of equipment have a responsibility for establishing information on emissions from their processes and devices; that research organizations should be encouraged to contribute significantly in this field; and that communities should develop information relative to their pollutant sources.

There is a need to make generally available information on sources of pollution and to analyze these data in order to avoid unnecessary duplication and to serve as a guide to others investigating these and related problems. In this regard we believe that it is necessary and proper that the activities of the Public Health Service in the dissemination of this type of information be expanded and continued on a permanent basis.

It is the consensus of our Group that no time should be lost in carrying out the suggestions made herein. The rapid growth of the population and of the national economy, and the attendant increase in the quantities of pollution from all sources indicates the need for immediate action.

In conclusion, members of Group B recommend that the Public Health Service implement the following program at the earliest possible date:

1. Intensive development of instrumentation for source analysis.
2. The provision for training of specialized personnel in source studies.
3. The encouragement of communities to assess continually the sources of pollution within their boundaries, with technical assistance from the Public Health Service if requested.
4. The systematic collection, analysis and dissemination of information on emissions from all sources in cooperation with local communities.

# HEALTH EFFECTS OF AIR POLLU ION

Concern about the actual and potential threat to health of atmospheric pollution has run through most of this Conference. Several aspects of the health problem were noted by Dr. Burney in his opening remarks. Further references were made in various ways by Dr. Hilleboe, by Senator Kuchel and by Dr. Leake in their remarks at the opening session. In his discussion of "What does air pollution do to humans?" Dr. Dixon summarized the current knowledge of the relation of atmospheric pollution to health.

From this general overview, Group "C" at yesterday's day-long session probed somewhat deeper into the problem. Our 200 participants devoted the four hour morning session to look at general and several specific aspects of the health effects of air pollution.

Mentioned in the first plenary session were several acute air pollution episodes. Our group analyzed in somewhat more detail these acute episodes and lessons to be learned from them. In medicine we often refer to subclinical disease. Along with the specific Donora and London episodes, consideration was given to other incidents that approached the level of clinical recognition.

In future years such events may well be recognized as acute episodes of lesser intensity when our observation acumen is sufficiently sharpened. Possible approaches to more scientifically and accurately studying these incidents were noted.

Also mentioned to you on Tuesday were possible chronic disease entities that might be attributed to long time and repeated exposure to low concentrations of air pollutants. Group C paid particular attention to this matter. Laborious epidemiologic studies were described which are essential to the elucidation of the role of polluted air in the causation of chronic diseases. Particular attention was paid to chronic bronchitis, asthma, emphysema, cardiac and circulatory diseases, and to cancer. There was some probing into the intricacies of the anatomical and physiological changes in the lungs and other organ systems resulting from exposure to atmospheric pollutants.

From this four-hour session a number of generalizations seemed to come forth to those of us who participated. Much knowledge about the medical effects of polluted air is already available. Many potentially important and significant leads have been uncovered. The body of knowledge is increasing in many directions and at an accelerating rate. I, for one, was heartened by the evidence of progress. I'm sure that as each of you studies the reports we heard yesterday, you also will catch a glimpse of the horizons ahead through the gradually dissipating smog of the unknowns.

I cannot resist stating to you that over 95% of our participants stayed with us right up to the 1:00 P. M. adjournment of the morning session, so intense was the interest in the presentations.

In the afternoon, Group C divided into six discussion groups. The objective was for each group to consider specific questions that had been propounded by the Inquiries Committee. It was understood that the groups could go beyond the specific questions. At the end of the afternoon we reassembled and listened to the reports from each of the six groups.

In the time available, I cannot give you their complete reports but will attempt to summarize the conclusions and recommendations. There were several general recommendations that came in one form or another from several of the groups.

1. There seemed no question that the national Air Pollution Program should be continued and expanded.

2. In the continuance of the program it was emphasized that problems in air pollution will be with us indefinitely, so the specific enabling law should have no specified terminal date. As one group stated, there should be "permanent extension of Public Law 159."

3. It was recommended that placing a legal ceiling on appropriations was unrealistic; budgets should be considered annually by the Congress on a basis of current program needs and potential for effectively utilizing the funds.

4. It was concluded that since there are many unanswered health questions there should be acceleration of research on the health effects of air pollution. In such an accelerated program there should be participation by all agencies such as official health agencies, research organizations, universities and industries, including the automobile industry.

In this regard it was emphasized that there are existing research potential that, for lack of funds, are not being utilized.

5. It was recognized that intensification of control efforts should not and cannot await the definitive answers to many of the medical problems. However, there was agreement that it is imperative that such answers be found at the earliest possible time since they will serve to better guide the development and design of control programs.

6. From one group came agreement that nuisance due to air pollution should be regarded as a public health problem. Among the reasons noted were the effects upon efficiency and upon emotional and physical comfort and well being. It was felt these effects need not necessarily be manifestations of specific disease entities.

7. One group specifically considered the responsibility of the voluntary health agency in the air pollution field. In summary, it was concluded that such agencies should participate in promoting air pollution control, in promoting and sponsoring health research, in supporting official agencies and in an educational capacity.

8. Another group paid particular attention to the responsibility of practicing physicians and recommended that: First, organized medicine, through

national, State, and local medical societies, should collect and disseminate air pollution information to its membership; second, that the proceedings of this Conference be made available to physicians and public health authorities; third, that private physicians individually should be encouraged to use local facilities and services, such as those of local health departments or air pollution control authorities, to assist them in the management of clinical problems that may involve air pollution. Physicians should also serve as interpreters of the health aspects of the problem to their patients and to others in the community.

9. The question of "How would you estimate the impact of air pollution on your community health?" was considered by another group. Mentioned were eye irritation, irritation to the respiratory tract and upon emotional well being, including anxiety about the possible hazard to health. They noted that because of incomplete information on the health effects of air pollution, community hysteria may develop which, among other things, may lead to unnecessarily restrictive laws.

10. Still another group considered the question of what should be the responsibility of government—Federal, State and local—in the determination of the health effects of air pollution. It was concluded that the current plan of cooperation among the three levels of government is effective and should be continued. In this instance I should like to quote the complete statement of the sub-group: "There was general consensus that grossly inadequate information on health effects of air pollution was available upon which to base sound, nondiscriminatory legislation to effectuate control."

In discussing the role of government, there was no intent to imply that the responsibility was government's alone, but that, indirectly, research groups, academic institutions, as well as other groups, do have a share in the responsibility of determining the health effects of air pollution.

There was developed a set of recommendations designed to offset the lack of information on health effects and to delineate major responsibilities of the several levels of government:

1. In general, air pollution problems *common to the country as a whole* should be the responsibility of governmental agencies at all levels.

2. Problems more local in nature should be the primary responsibility of the pertinent area, but consultative advice and guidance should be available and sought from State and Federal agencies.

3. Emphasis was given to an integrated team approach to the determination of the health effects of air pollution to provide efficient correlative data. Such a team approach would entail the collection of concurrent medical, epidemiologic, and aerometric data.

4. It was felt that local resources were not being utilized adequately and that additional useful medical statistics could be secured within the framework of well organized data collection programs involving the local health resources and facilities, such as health departments, registrars of vital statistics, practicing physicians and hospitals.

5. Although more could be done with existing facilities, it was felt that an adequate program at the local level in most instances would require augmented financial support and intensive stimulation of interest.

6. As such significant health effects data become available, every effort should be made by the Federal agencies to disseminate such information to the States and, similarly, by States to local agencies.

7. Since adequate methodology in determination of health effects and sufficient competent personnel were not yet available, it was felt that a crash program for definition of health effects was certainly not indicated at this time. In this regard, there should be promoted, instead, an orderly but aggressive program of research in this area.

## ECONOMIC AND SOCIAL EFFECTS OF AIR POLLUTION

### Education

We recommend a continuing and intensified education program in the following four areas:

1. The education of personnel so that the problems of the future can be met and solved.

2. The education of industry by the dissemination of existing information to industry's obligation for air pollution abatement.

3. Education of and assistance for public officials in meeting local problems of air pollution.

4. The education of the general public in its obligations in controlling its own contribution to air pollution problems.

### Research

The following areas need study:

1. The effect of air pollution upon organisms and materials.

2. Extent and cost of air pollution on our economy and society.

3. Extent and cost of air pollution control on our economy and society.

4. Research into administration and legal techniques of air pollution control.

5. Research on sociological implications of air pollution and air pollution abatement.

6. Research and development of new and less costly air pollution control techniques.

7. The encouragement of research in by-products and development investigations.

Action

The Group recommended:

1. The continuation and expansion of Public Law 159.

2. The creation of a stronger liaison between Government and the general public and the establishment of a liaison between Government and industry. (With these efforts toward better liaison, we will have an understanding of the meaning of our living together in a cooperative effort.)

3. Governmental cooperation with local organizations in the development of programs and effective measures which will further effective and fair air pollution control.

4. Machinery be set up to promote periodic national meetings for the comparison and evaluation of air pollution control progress.

## CONTROL METHODS AND PROCEDURES FOR AIR POLLUTION

During the past decade, substantial progress has been made in basic knowledge and in the technology and practice of air pollution control. Industry and government both have contributed to this progress. Industry is spending millions of dollars a year in research and hundreds of millions a year in control of air pollution. Government and nonprofit agencies are also spending large sums of money for similar purposes. These expenditures have resulted in substantial improvement.

Scientific, engineering and trade associations have held numerous conferences on air pollution in recent years. Their publications have presented useful scientific and engineering developments. These publications have promoted wide application of the new knowledge, particularly in larger installations, but more effective use of the present knowledge can be made.

The means are presently available for adequate removal of many pollutants within cost limits which are economically feasible. Such means are not available for certain other pollutants, but in many of those cases removal is desirable but not essential. The economic justification depends on the conditions which exist in each instance. For many of those pollutants for which the need of control has been most urgent and widespread, economical methods for correction have been developed. In certain industrial applications the control cost results in a direct charge to the local industry which, in turn, passes this cost as an increase in consumer cost to the local community benefiting from the application of control; in others, it results in a customer cost which is borne nationally. In the case of municipal and domestic sources, the direct cost of control is borne by the community.

It is recognized that a public awareness should be directed to the value of industry standards and principles applicable specifically to new installations having a significant air pollution potential for the purpose of minimizing the development of new air pollution problems in the future.

### Recommendations

1. The Committee recommends that it is a joint responsibility of government and industry to sponsor and conduct research on air pollution control. It is recognized that industry welcomes government support of research as a means of identifying, defining, and developing approaches to solutions. The responsibility for the solution of specific problems associated with a specific industry or plant lies with that industry.

2. Further research and development should be implemented to expedite controlling emissions from high temperature combustion and metallurgical operations.

3. Further studies must be undertaken to develop economic means for the removal of low concentrations of gaseous pollutants such as oxides of sulfur and nitrogen from combustion gases for application in areas where these may be a problem.

4. We urge that the education and training of engineers in the field of air pollution control should be continued and if possible expanded.

5. Recognition should be accorded to the importance of developing economical survey techniques that can quantitatively define the relative importance of the application of control equipment in a community.

6. Properly designed and engineered control equipment should be incorporated in the initial plant specifications. Codes for guidance in this practice should be developed by voluntary industry groups and engineering societies. Support for this endeavor should be encouraged.

7. In regard to automobile exhaust emissions, the following recommendations are made:

A. Work on the development of analytical techniques and instrumentation and studies of exhaust gas composition should be continued by both industrial and governmental agencies.

B. Those industries presently engaged in developing exhaust system control devices should continue their work at a vigorous rate.

C. The automobile industry should continue its study of the maintenance aspects of the automobile exhaust-air pollution problem.

8. Research agencies should continue their program on the health aspects of all air pollutants in order to expedite the development and application of control methods.

9. The study of atmospheric reactions should be continued so that as control methods become available those urban areas affected with an air pollution problem can determine whether or not the application of such control methods will be effective in their particular problem.

## ADMINISTRATIVE ASPECTS OF AIR POLLUTION

1. Q. What are the respective responsibilities of the individual, business and industrial activities, and public agencies in the prevention and control of air pollution?

A. The control of air pollution requires the cooperation of the whole community. While an industrial source may contribute more than an individual, it should be recognized that the total contribution to the air pollution load by individuals may equal or exceed that of industry. The individual has responsibility to prevent or reduce air pollution resulting from open fires, trash incineration, home heating plants, and improper functioning of his automobile within the technological limits which exist at the time.

As an integral and vital component of the community, business and industry have a responsibility in the prevention and control of air pollution as a good neighbor and for the general welfare of the community. In this regard, it is incumbent upon them to recognize that air is a limited natural resource. The use of the air is common to all, and neither public use nor custom grant special consideration to any components of the community.

Local public agencies have responsibility for dealing with the air pollution problem through several approaches. First, the community must take the initiative in providing services for the collection and disposal of refuse in a manner which will not pollute the air. Second, the public agencies should conduct their operations in an exemplary manner to avoid pollution of the air. Finally, that local or regional public agency, capable of dealing with the air pollution problems in the area, should be given the responsibility for the conduct of a control program. This intends that recognition be given to those factors common to such an area because of topography, meteorology, sources of pollutants, and effects.

The appropriate State agencies should assume responsibility for leadership, technical assistance, and guidance to the local control agencies. In this manner, the State can function effectively by assisting local agencies in appraising their air pollution problems and providing necessary technical assistance. The State agency should also maintain a continuing program of study and appraisal of air pollution levels throughout the State. The State should encourage local control legislation and local control operation, where feasible, but the State should assume the responsibility for control in all those areas where the organization of local or regional programs is not feasible, or where a local control program is needed and has not been established.

The most effective manner in which to assess relative responsibilities in a community would be by means of preliminary study and appraisal of the air pollution problems. This should be followed by a determination of responsibilities in a cooperative manner, recognizing the equities involved.

The role and responsibility of the Federal Government is clearly expressed in Public Law 159 of the 84th Congress. This Act provides for the conduct by the Public Health Service of a program of research, technical assistance, and training. This law was enacted in 1955 and provided for an initial period of five years of Federal activity in this field with the intent of reappraising the problems and needs at the end of that time. Although much needed research results have been achieved, it is not possible to accomplish the objectives of the Act within the five-year period. For example, the effects of air pollution on

health and the control of automotive exhaust gases are but two of the many vital problems on which further work needs to be done. In the public interest there is continuing need for research which can best be conducted by the Federal Government. The nation-wide importance of air pollution problems indicates the real need for amending Public Law 159 to extend the authorization for the program.

The Congress in enacting Public Law 159 also included a provision limiting the annual appropriation to a maximum of $5 million. Air pollution research includes many complex aspects involving study over an extended period of time, particularly those concerned with the chronic health effects. This fact, together with the possibility of an engineering or medical research "breakthrough" which might make desirable an expansion of activities for further development and exploitation, suggests that no appropriation limitation should be included in the extension of the Act. The annual budget review and appropriation procedure provide adequate financial control. The air pollution problems of our Country are so vast in scope and, if unchecked, will without doubt increase in severity due to the rapid increases in industrialization and urbanization which are taking place; therefore, we feel it is undesirable that a ceiling be placed on the funds authorized by the Congress for work by the Federal Government in this field.

II. Q. In general, in the conduct of air pollution control programs.

(a) Should air pollution control be organized on a local basis? Regional? State? Other?

A. Public Law 159 specifically declares it to be the policy of Congress to preserve and protect the primary responsibilities and rights of the States and local governments in controlling air pollution. This policy declaration is clearly in harmony with the Federal Constitution under which the police powers, with certain exceptions, are reserved to the respective States. Thus, the control of air pollution, as an exercise of the police power, is a responsibility primarily of the States and, to the extent delegated by them, to their political subdivisions.

In many cases, air pollution can be dealt with by a single local political subdivision. Air pollution, however, frequently does not respect political jurisdiction and consequently many communities are unable to deal effectively with this problem on an individual basis. Experience, thus far, clearly indicates the desirability of meeting the air pollution problem on a problem-area basis. This would involve, as the case may be, purely local or regional efforts, the latter by interlocal or interstate cooperation. As one practical approach, the Council of State Governments has suggested State enactment authorizing cooperative activities between local subdivisions on a joint basis. The act would permit the exercise of power already possessed by a political subdivision in conjunction with one or more communities for a common end. It should be noted that the suggested act is drafted for use between or among communities whether or not they are located within a single State.

There are some situations which are primarily regional and dependent upon a number of common factors, such as weather, topography, population concentration, and industrial development, among others. A number of State legislatures have recognized this need and have enacted appropriate enabling legislation. In the control of air pollution, it is clear that the functions of the States lie in two general categories: (1) those concerned with the legal delegation of appropriate powers to their political subdivisions or groupings of them, and (2) those concerned with the direct activities of the State government itself. For the first, State initiative and action is a necessary antecedent to effective local or regional activities. In addition, there is need to encourage cooperation and coordination between States in dealing with interstate air pollution problems. The Federal Government in the exercise of its jurisdiction over commerce on navigable waters should delegate authority for control of air pollution to the States.

(b) Q. What relative emphasis should be placed on education, voluntary action, regulation, legal enforcement?

A. The active cooperation of the various components of the community is most desirable and essential for a successful air pollution program. There is also the necessity of achieving a proper balance among the elements of a community air pollution program, appropriately tailored, which would include among others, education, cooperation, regulations, and legal enforcement. Education of all concerned plays an important role in securing undestanding and cooperation. It provides the means of describing the problem, needs of the community and what can be done.

The rules and regulations establish the objectives. The promulgation of such rules and regulations performs the significant function of guidance and provides a uniform approach, where applicable, to the air pollution problem. Obviously, for the recalcitrant few, there is need to resort to legal remedies. The legislation must be reasonable and just, based upon a sound technical foundation.

(c) Q. What is the role of the zoning in air pollution control?

A. At the present time, satisfactory acceptable variations in standards of air pollution control relating to zoning and planning have not been evolved. It is recommended that planning and zoning experts, working together with air pollution officials, devote further study and research to this problem.

(d) Q. How should air pollution control be paid for?

A. This question involves two aspects: first, that involving the cost of operating the control agency; and second, the cost of providing and operating processes or equipment for actually preventing or controlling air pollution.

All segments of the community are concerned with the control of air pollution and many of them are affected by the financial equities involved. The official control actions, undertaken in the over-all public interest, should be supported therefore by public funds. This may be tempered by an appropriate system of equitable fees covering the cost of special services rendered by the official agency to individuals or business and industrial organizations.

On the other hand, every individual or organization must be expected to defray the cost of necessary steps in preventing or controlling air pollution which would otherwise result from activities carried on or controlled by him.

# APPENDIX

## Organizations Represented at the Conference

### Civic and Voluntary Organizations

Air Pollution Control Assn.
Air Pollution Control League of Cincinnati
American Automobile Assn.
American Cancer Society
American Farm Bureau Federation
AFL-CIO
American National Red Cross
American Veterans Committee
Chamber of Commerce, Cleveland, Ohio
Chamber of Commerce, Greenville, S. C.
Chamber of Commerce, Wichita, Kans.
Citizens Committee on Air Pollution, Lakeland, Fla.
D. C. Tuberculosis Assn.
Florida Air Pollution Control Assn.
Garden Club of America
General Federation of Womens Clubs
Izaak Walton League
Kiwanis International
Lions International
National Council of Catholic Women
National Council of Churches of Christ in U. S. A.
National Council of Women
National Council on Stream Improvement
National Education Assn.
National Health Council
National Safety Council
National Tuberculosis Assn.
National Wildlife Federation
National YWCA
Stream and Air Pollution Abatement Council of Houston, Tex.
Teamsters Joint Council No. 13, St. Louis, Mo.
U. S. Chamber of Commerce
Wildlife Management Institute

### Trade & Professional Associations

Air-Conditioning & Refrigeration Inst.
Air Moving & Conditioning Assn., Inc.
Air Transport Assn.
American Assn. for Advancement of Science
American Assn. for Health, Physical Education and Recreation
American Foundrymen's Society
American Gas Assn.
American Geophysical Union
American Hospital Assn.
American Industrial Hygiene Assn.
American Institutes of Architects
American Institute of Planners
American Iron & Steel Institute
American Medical Assn.
American Municipal Assn.
American Nurses Assn.
American Osteopathic Assn.
American Paper & Pulp Assn.
American Petroleum Institute
American Public Health Assn.
American Public Works Assn.
American Society of Heating & Air Conditioning Engineers
American Society of Mechanical Engineers
American Society of Planning Officials
American Trucking Assns., Inc.
American Water Works Assn.
Armed Forces Chemical Assn.
Assn. of American Railroads
Assn. of Petroleum Re-Refiners
Automobile Manufacturers Assn.
Bituminous Coal Institute
Can Manufacturers Institute
Coal Producers Comm. for Smoke Abatement
Council of State Governments
Institute of Scrap Iron & Steel
Inter-American Bar Assn.
Lead Industries Assn.
Los Angeles County Medical Assn.
Manufacturing Chemists' Assn., Inc.
Michigan State Supervisors Assn.

Natn. Assn. of County Officials
Natn. Assn. of Home Builders
Natn. Assn. of Manufacturers
Natn. Heating & Air Cond. Wholesalers Assn.
Natn. Industrial Council
Natn. Institute of Municipal Law Officers
Natn. Paint, Varnish and Lacquer Assn.
Natn. Slag Assn.
Pennsylvania Manufacturers Assn.
Portland Cement Assn.
Tobacco Industry Research Committee
U. S. Conference of Mayors

## State, Territorial, and Federal Agencies and Officials

State Health Departments

Alaska
Arizona
California
Colorado
Connecticut
Delaware
Florida
Georgia
Hawaii
Indiana
Iowa
Kentucky
Maryland
Massachusetts
Michigan
Minnesota
New Hampshire
New Jersey
New York
North Carolina
Ohio
Oklahoma
Pennsylvania
Puerto Rico
Texas
Virginia
Washington
West Virginia

Federal Agencies & Officials

Dept. of Agriculture
Atomic Energy Commission
Dept. of Commerce
  Bureau of Standards
  Weather Bureau
Department of Defense
  Dept. of the Army
  Dept. of the Navy
Federal Housing Administration
Dept. of Health, Education & Welfare
  Food & Drug Administration
  Public Health Service
House of Representatives
  Sub-Committee on Inter-Governmental Relations
Department of Interior
  Bureau of Mines
  National Park Service
Department of Labor
Library of Congress
National Academy of Science
National Research Council
National Science Foundation
Tennessee Valley Authority
U. S. Senate
Veterans Administration

Other State Agencies & Officials

California Legislature
Florida Air Pollution Control Comm.
Interstate Sanitation Commission
Michigan Asst. Attorney General
New Jersey Air Pollution Commission
New York Air Pollution Control Board
New York Dept. of Labor
North Carolina Dept. of Conservation & Development
Oregon Air Pollution Authority

Foreign Agencies

Canada: Dept. of National Health and Welfare
Philippines: Dept. of Labor
United Kingdom: Scientific Mission

## Local Agencies and Officials

City and County Health Departments

Alexandria, Va.
Allentown, Pa.
Arlington County, Va.
Ashtabula County, Ohio.
Baltimore, Md.
Beloit, Wis.
Charlotte, N. C.
Charlottesville, Va.
Chicago Heights, Ill.
Davidson County, Tenn.
District of Columbia.
Elkton, Md.
El Paso, Tex.
Fairfax County, Va.
Fredericksburg, Va.
Gallipolis, Ohio
Hampton, Va.
Huntington, W. Va.
Iredell County, N. C.
Joplin, Mo.
Kanawha-Charleston, W. Va.
Lorain, Ohio
Louisville, Ky.
Montgomery County, Ohio.
Nassau County, N. Y.
New Haven, Conn.
New York City, N. Y.
Oak Park, Ill.
Paterson, N. J.
Philadelphia, Pa.
Phoenix, Ariz.
Pittsburgh, Pa.
Roanoke, Va.
Royal Oak, Mich.
St. Louis, Mo.
Steubenville, Ohio.
Summit County, Ohio.
Toledo, Ohio.
Vineland, N. J.
Weymouth, Mass.
Wichita, Kans.

Air Pollution Control Agencies

Asheville, N. C.
Allegheny County, Pa.
Baltimore, Md.
Charlotte, N. C.
Chicago, Ill.
Cincinnati, Ohio.
Cleveland, Ohio.
Columbus, Ohio.
E. Chicago, Ind.
Gary, Ind.
Indianapolis, Ind.
Lehigh Valley, Pa.
Los Angeles County, Calif.
Louisville-Jefferson County, Ky
Milwaukee County, Wis.
Nashville, Tenn.
Newark, N. J.

New York, N. Y.
Orange County, Calif.
Perth Amboy, N. J.
Richmond, Va.
St. Louis, Mo.
San Bernardino, Calif.
San Diego, Calif.
San Francisco Bay Area, Calif.
Wheeling, W. Va.

Other Agencies and Officials

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Cincinnati, Ohio, Supts. Committee
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East Chicago, Ill., City Controller
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Glen Cove, N. Y., Mayor
Kern County, Calif., Supervisor
Los Angeles, Calif., County Counsel
Los Angeles, Calif., Dept. of Water & Power
Los Angeles, Calif., Sanitation Districts
Los Angeles, Calif., County Supervisor
Los Gatos, Calif., Mayor
Lynchburg, Va., Water Dept.
Muskegon, Mich., Supervisor
Orange County, Calif., Supervisor
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Pittsburgh, Pa., Asst. Solicitor
St. Louis, Mo., Mayor
St. Paul, Minn., City Testing Labs.
San Bernardino, Calif., Supervisor
San Diego, Calif., County Supervisor
Statesville, N. C., Building Insp.
Sulphur, La., Parish Police Jury Assn.
Wyandotte, Mich., Asst. City Engr.
Wheeling, W. Va., Mayor

## Universities & Research Organizations

Air Pollution Foundation
Armour Research Foundation
A. S. H. A. E. Research Laboratory
Battelle Memorial Institute
Baylor University
California Institute of Technology
Catholic University
College of Medical Evangelists
Columbia University
Duke University
Franklin Institute
Georgia Institute of Technology
Harvard University
Howard University
Institute of Medical Research
Jefferson Medical College
Johns Hopkins University
W. K. Kellogg Foundation
Kettering Laboratories
Lamar State College of Technology
Louisiana State University
Massachusetts Institute of Technology
Mellon Institute
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Northwestern University
Ohio State University
Ontario Research Foundation
Research Foundation, Colorado State University
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Southwest Research Institute
Stanford Research Institute
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Tulane University
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University of California, Los Angeles
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University of Pennsylvania
University of Pittsburgh
University of Southern California
University of Toronto
University of Washington
University of Wisconsin
Utah State University
Vanderbilt University
Virginia Polytechnic Institute
Wayne State University
Yale University

## Industries

Aerkem, Inc.
Air Preheater Corp.
Air Reduction Co.
Allen Sherman Hoff Co.
Allied Chemical Corp.
Aluminum Co. of America
Aluminum Co. of Canada
American Air Filter Co.
American Boiler and Affiliated Industries
American Can Co.
American Cement Corp.
American Cyanamid Co.
American Electric Power Service Corp.
American Incinerator Corp.
American Motors Corp.
American Smelting and Refining Co.
The Anaconda Co.
Appalachian Coals, Inc.
Armco Steel Corp.
A. S. H. Industries
Asiatic Petroleum Co.
Atlantic Refining Co.
Atlantic Research Corp.
Automotive Rubber Co.
Baltimore and Ohio Railroad
Baltimore Gas and Electric Co.
The Beryllium Corp.
Bethlehem Steel Co.
Bituminous Coal Research, Inc.
Boston Edison Co.
British Petroleum Co.
Buell Engineering Co.
Carolina By-Products Co.
Catalytic Combustion Corp.
Celanese Corp. of America
Champion Paper and Fiber Co.
Chemical Construction Corp.
Chrysler Corp.
Colorado Fuel and Iron Corp.
Columbia-Southern Chemical
Combustion Engineering Inc.
Commonwealth Services, Inc.
Connor Engineering Corp.
Consolidated Coal Co.
Consolidated Edison Co. of N. Y.
Continental Can Co.
W. W. Criswell Co.
Cummins Engine Co.
Detroit Edison Co.
Dorr-Oliver Inc.
Dow Chemical Co.
The Ducon Co.
E. I. Dupont de Nemours and Co.

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Dustes Corp.
Ebasco Services, Inc.
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Esso Research and Engineering Co.
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General Motors Corp.
General Petroleum Corp.
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Green Fuel Economizer Co.
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Gulton Industries
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Hazleton Laboratories, Inc.
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Humble Oil and Refining Co.
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International Minerals and Chemical Co.
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Maryland Casualty Co.
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Minnesota Mining and Mfg. Co.
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National Lead Co.
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North American Weather Consultants
Owens-Corning Fiberglas Corp.
Owens-Illinois Glass Co.
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Peabody Engineering Corp.
Pennsalt Chemical Corp.
Pennsylvania Railroad Co.
Peoples Gas Light and Coke Co.
Perkin-Elmer Corp.
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Philco Corp.
Philip Morris, Inc.
Phillips Petroleum Co.
Potlatch Forests, Inc.
Public Service Electric and Gas Co.
Pulverizing Machinery Div.
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Research-Cottrell, Inc.
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L. Sonneborn Sons, Inc.
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Southern Counties Gas Co.
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Studebaker-Packard Corp.
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Texas Gulf Sulphur Co.
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Union Carbide Corp.
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Assemblyman Thomas Rees, Los Angeles

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# HIGHLIGHTS OF CONFERENCE RECOMMENDATIONS

The complete text of the conclusions and recommendations of the six discussion groups which were presented to the National Conference on Air Pollution is included in this report, beginning on page 27.

The following are a few of the most significant recommendations which were included by several of the groups:

(1) The extension and expansion of the Federal Air Pollution Act with the elimination of the expiration date and appropriation ceiling;

(2) Increased attention to recruitment and training of qualified personnel in technical fields related to air pollution;

(3) Expansion of research to determine the health effects of pollutants;

(4) Additional research to devise effective control methods for various types of emissions, with particular attention to problems of automobile exhausts;

(5) Increased research to develop more effective and economical instruments and methods for monitoring and analyzing pollutants;

(6) Endorsement of the policy contained in the Federal Air Pollution Act in regard to the responsibilities of State and local air pollution control agencies, as well as industry and other institutions, in formulating and carrying out abatement programs;

(7) Increased attention to education of the public on air pollution problems.

The Conference Proceedings, which will include the complete text of all formal presentations and a detailed summary of all discussion, is now in preparation and will be available about March 1, 1959, from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

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